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Osgood's No. 2 Excavator.

We present, with this, engravings showing in plan and elevation a new excavator, now being built by the Osgood Dredge Company, Albany, N. Y. This company have for some time built an excavator somewhat similar in construction to this, but a larger and heavier machine; this one is designed to meet the demand for a machine less powerful than the large one, but which would under many circumstances meet all the requirements. It cannot, however, be called a small machine of its class, as in fair material it will dig 1,000 yards per day, and can be worked at the rate of three 1½ yard dippers full per minute. All improvements in dredging and excavating machinery that the company has introduced, are, so far as required, embodied in the design of this machine.

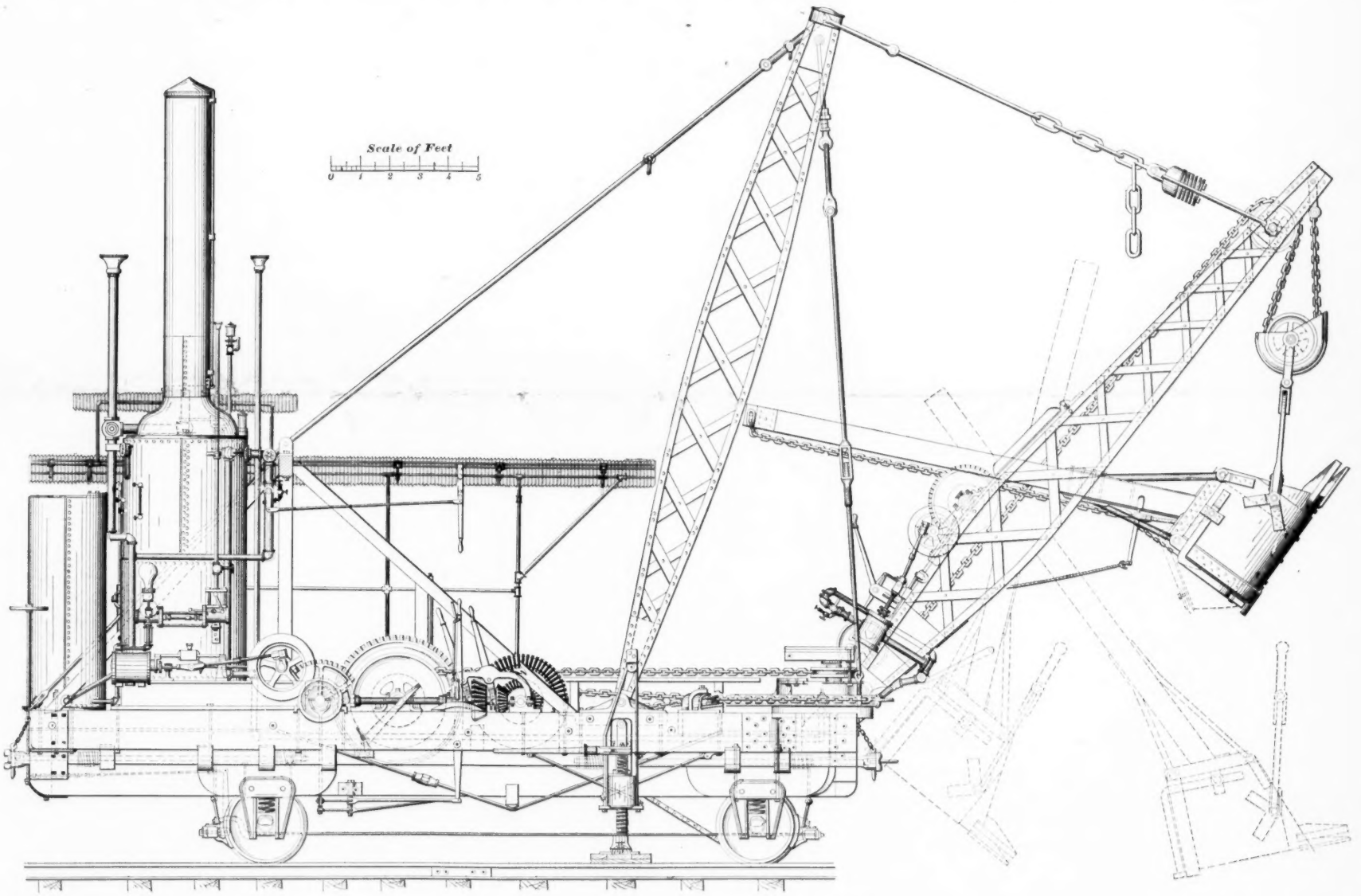
The car upon which the machinery is arranged is adapted to be run in an ordinary railroad train, and is also self-propelling. It is mounted upon 5½ inch steel axles, placed 16 feet apart, each axle having four journals, supported in heavy jaws, similar in construction to those used on railroad cars. When desired a four-wheel truck may be placed at either or both ends, in place of the axles.

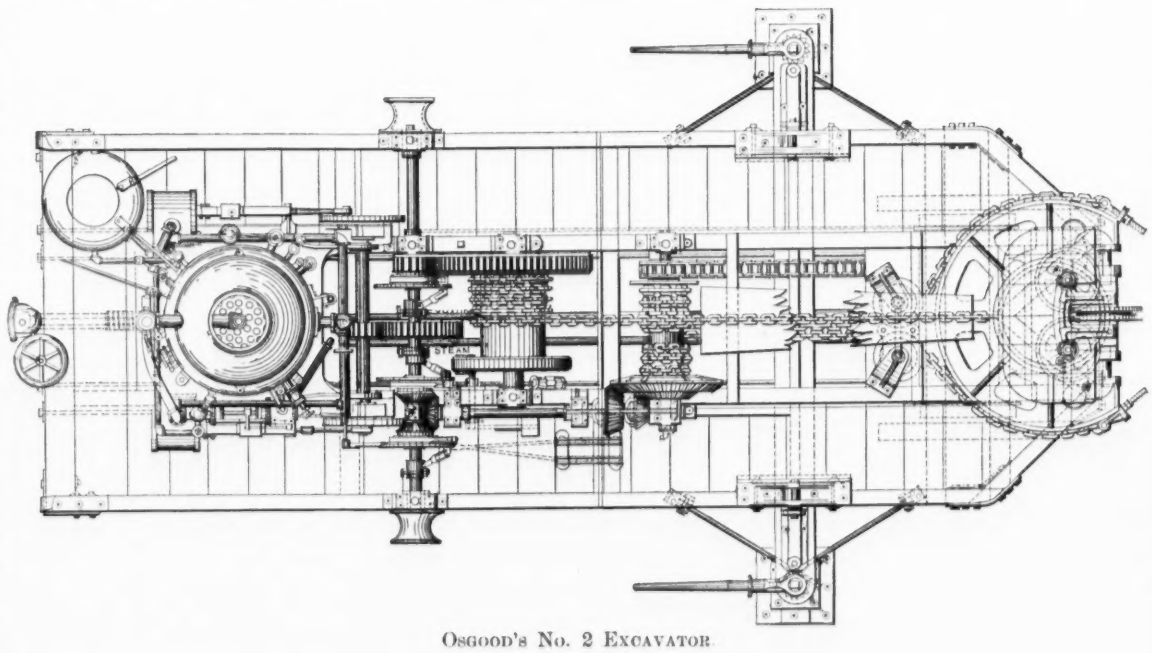
The car moves up to its work on a temporary track, and in digging is supported upon two steel jack screws, provided with rachet tops for quick adjustment. One of these screws is directly under each foot of the *A* frame; they support nearly the entire weight of the machine, and relieve the car of the heavy strains due to working.

The power consists of a pair of 8″×10″ engines, geared 15 to 1 to the hoisting drum, the arrangement of gearing being clearly seen in the plan view; also a pair of crowding engines, 6″×8″, fitted with reversible link motion. The crowding engines are located on the boom, giving the dipper tender sure and quick control of the dipper. Steam is supplied to the engines by a vertical boiler 53″×102″, made of ⅜-inch plates, stamped 50,000 T. S. The boiler is provided with a steam pump and injector, either of which may be used for feeding.

The hoisting drum, 20 inches diameter, is operated by a band friction on the countershaft. This shaft also carries two miter gears fitted with band friction, which drive, in either direction a short line shaft. This latter shaft drives the swinging drum and propelling gear through bevel wheels.

The swinging drum is loose on the shaft with a sleeve keyed in it, and is driven by the larger bevel wheel on the line shaft. On the drum shaft at the opposite end of the driver is a horn wheel from which a chain is operated to propel the car. Motion is given to the drum shaft for this purpose through the





OSGOOD'S NO. 2 EXCAVATOR

small bevel wheel on the line shaft. This makes the swinging and propelling motions entirely independent, one of the other.

The turntable is swung by means of chains which take hold of eye bolts on its periphery. These chains extend directly from the turntable to the swinging drum. One lever only is used for swinging. When this lever stands in a vertical position both miters that drive the line shaft are free; when it is moved to the right the friction engages one of them, revolving the shaft in one direction; moving it to the left engages the other, and revolves the shaft in the opposite direction.

All clutches are those referred to as band friction, which are found to work very easily and surely, and avoid all danger of breakage resulting from the use of positive clutches.

The dipper has a capacity of 1½ yards, struck measure. It is made entirely of steel, and provided with three solid steel teeth for loosening hard material.

Altogether the machine is very compact, and the arrangment such that the machinery is worked easily and quickly, while the comparative quick motion of the engines—15 to 1 of the drum—makes it very powerful in digging. The weight of the machine is about 28 tons.

Upsetting Steel and Iron.

By S. W. Goodyear.

I have recently read some things in relation to the upsetting of iron and steel which are so much at variance with the generally-accepted ideas on the subject, and at the same time so flatly contradict what the every-day experience of many mechanics shows to be facts, as to prompt me to offer some testimony.

First, as to the "upsetting of iron"—for under this heading may be found in a trade journal of recent date a very interesting reference to the "quality of movements of the particles of iron under pressure or percussion. * * * Red-hot iron can be pressed to fill a mould as clearly and exactly as so much wax could be. * * * Cold iron can also be moulded into form by pressure. * * * The heading of rivets, bolts and wood-screw blanks shows some surprising results in the compression of iron; a No. 6 one-inch screw requires a piece of wire slightly more than 1½ inches long to form it. Yet the total length of the screw blank headed is just one inch. * * * Now, it has been proved by experiments with shorter bits of wire that less than five-sixteenths of an inch of the extra eight-sixteenths is required to form the screw-head. What becomes of the remaining more than three-sixteenths of an inch in length of an original 1½ inches that make the one-inch screw blank? There can be but one answer; the iron is driven upon itself * * * so that $1\frac{1}{16}$ in. of wire are compressed into seven-eighths of an inch in length without increasing the diameter of the wire."

This flatly contradicts the assertions of scientific investigators, who have, after making many exhaustive experiments, concluded that cold working of iron and steel, such as hammering, rolling, drawing, pressing, upsetting, etc., do not increase the specific gravity. Is it likely that in the many careful experiments made by the most painstaking of men the experiments, involving the most accurate measurements possible, added to unquestionable tests of specific gravity, there has been uniformly a misconception of the real facts, and that experiments made by measuring a blank piece of wire—possibly with a box-wood rule—before heading, and again measuring the length of blank produced by heading the same wire are to *upset* this proven fact, that ordinary cold working does not make iron and steel more dense?

Where does the iron go, then? It goes to round up to the contour of the die, in which the blank is headed, that entire part of the block constituting the body, and to fill the die for the entire length of the body of the blank, through the upsetting process, to a fullness which in solid dies defies the efforts of any but the best of carefully-hardened and tempered steel punches, from best of steel, to push out of the dies after heading, rivets and screw blanks, making the question of what steel to use for "punching out in solid die heading" one of the most important connected with the business.

In heading a screw-blank or rivet, the first effect produced by the longitudinal pressure applied is to upset the piece of wire for its entire length. The diminution in length will produce an exactly proportionate increase in diameter up to the point when the wire fills the die so tightly as to transfer the most of the upsetting effect of the continued pressure to that part of the wire not encircled by the die, and then comes the heading, which begins by increasing diameter, and proportionately decreasing length, the metal being in a measure held by contact with the die and heading punch from lateral expansion. As the pressure continues, it assumes first a pear shape, simply following the not necessarily written law under which all metals under pressure yield in the direction of the least resistance, and soon a shoulder is formed, which, coming in contact with the face of the die, or bottom of countersink, depending upon the shape of die, the direct or entire resistance to the pressure applied has no longer to be supplied by the body of the wire as at first. But still, as the pear-shaped bulb is gradually pressed out of that shape into the shape required in the completed blank or rivet, a time will come when a portion of the superfluous metal back of the body of the blank, or representing the center of the head, can escape more easily in the direction of the pressure, thereby still further increasing the diameter of the body of the blank, than to escape altogether in a lateral direction under the immense pressure required toward the completion of the heading process.

"*Without increasing the diameter of the wire*," we quoted, *it would not be possible*, in any commercial sense, to do anything of the kind. Did the writer who stated as a fact that this was the rule realize the improbability of the statement which he virtually makes, *i. e.*, that over 17½ per cent. of the wire entering into the body of the blank described by him has been lost, if, as he says, the diameter remains unchanged?

I once made some carefully-conducted experiments to prove or disprove the truth of the assertion, which I had often made, that cold swaging did increase the specific gravity of steel, but which was denied by those who, having learned by actual experiment that other cold working did not, felt sure that the effect of cold swaging would be the same as that of other methods. My experiments were made with pieces of steel rod, each two feet in length, by reducing them by cold swaging until they were nearly eight feet long, and, having first carefully measured the original length and diameter, the increased length and decreased diameter was to show by measurement whether the specific gravity had been increased by swaging. I have not the figures at hand, but they showed on my side; still, when I presented them to my opponents, they met me with the statements that "there was too little difference to talk about, and, if my measurements had been absolutely correct, I had established nothing further than to appear to show the exception, which proved the rule. Cold working did not increase density; this was a well-known principle." Well, it was not much. The fraction of an inch which showed the difference in length of pieces from what they should have been, had the specific gravity remained unchanged, was represented by a figure in the third or fourth place in decimals—not much like the $0.1875 = \frac{3}{16}''$, which the writer from whom we have quoted would have us believe was lost from 1½" in length, when it is considered that in my experiments there were pieces sixty-four times as long in which lost metal might hide, and still not more than the one hundredth part as much had hidden in the eight feet as is claimed for 1½". Some facts are hard to swallow unless dressed up to appear reasonable. "Upsetting iron," as applied to heading, can be easily *upset* by anybody who will take the time to compare diameters and specific gravity of wire before heading with those of headed blanks.

"Upsetting steel" is spoken of by some persons, whose information on the subject of steel working is very extensive, as one of the most pernicious of practices, and, by the way the subject is treated, one might suppose that they fully believed that steel was made up of fibers, which must be always worked in the one direction. Steel is of a crystalline nature—not fibrous—and such of it as will be ruined by upsetting within reasonable limits, the operation being performed intelligently, is not good, sound steel.

Pursuing the subject of heading, I can testify that in the days when our grandfathers worked steel I made heading dies of two inches diameter by upsetting 1¼" octagon steel, which stood to do as much work as any that I could make from steel of other shape and size. Of hundreds which were made in this way, I do not remember that seams or cracks resulted from upsetting in a single instance. If the steel was sound, and the work in upsetting was so distributed as to affect all parts of the mass alike, why should they?

As to upsetting cold chisels, strips of sheet steel, iron, or pieces of steel of any shape which are so slender as to double up like straws from the power of the blow, there are not enough blacksmiths wasting time and injuring steel in that way to call for any protest. Steel is hammered with a view to improve it many times, in these later days, in a manner so much like that in vogue with the "old chaps" that it is a wonder that so many of them have ceased from labor without ever having been told that they had "monkeyed" steel. Well, if the devil has only got those smiths who hammered cold steel, there are not many smiths in his ranks yet. Heating steel as hot as it will bear and working it while hot, with injunctions not to try to draw cold steel, never to upset, may be construed to mean: hot as is best for steel, no hotter; not *cold*, but continue hammering till the grain of the steel is well closed up and finer for hammering at a low heat than it could possibly be made if the hammering was all done while the steel was hotter. It don't seem that *everybody* does write in the papers against heating steel too hot, and *nobody* can come to the conclusion that half the trouble is caused by too little heat, if his experience and opportunities for observation have been the same as mine.

What a difference it makes where a chap, old or young, stands to look at a thing. But I am off the track; upsetting steel is the question. The screw-blanks which were headed in the upset dies were threaded with rotary cutters. These cutters may be described as a section of a worm gear, the shape of tooth being that of the space between threads on a wood screw, and the cutter having a rotary motion in keeping with the rotary motion of the screw and with its own longitudinal motion, as it traversed the length of the screw which it cut. The best of steel, according to our best judgment, was used for these cutters; but running through many of the best brands, from "Jessup's" to "Hobson's Choice Extra Best," these cutters did not stand as it seemed they ought to do. I was anxious to try a high grade of a certain brand, of which I could get none of the right size till it could be imported (this was in the days of the old chaps—grandfathers). I had some ½" or ⅝" round; the cutters were to finish round, over ¾" diameter; I could not wait, so I made some cutters by upsetting the steel which I had. These cutters stood to do five times the work of the cutters I had been using; and, willing to "let well enough alone," I continued using the same size of steel and upsetting.

I once had for my job the lathe work on the hook for the Wheeler & Wilson sewing machine. As it came to me it was nothing more or less than a round-headed steel bolt, made in just the same way that a blacksmith would make any solid headbolt, by drawing a body to pass through the heading tool and upsetting the head. After this lapse of time—thirty years—I can hardly be expected to remember the character of each particular hook, but I don't remember that one of them was unsound as a result of upsetting. If steel gets too much work in one part, and not enough in another, in any direction, hot or cold, it is likely to get broken up. Upsetting need not take all the blame. How much difference in fracture does any one suppose will be found between breaking a bar f steel crosswise and breaking a piece of the same length of the width of the bar the other way of the grain? Cut two pieces of steel, each two inches long, from a two-inch square bar, and draw one of them down to one inch square, or eight inches long in the direction of the length; draw the other piece to the same size and length by upsetting at every other blow, or drawing crosswise. Who believes that the tool made from this last piece will be inferior to the one made the right way of the grain? *Some* bars of steel, and steel for *some* uses, *can* be improved by the work which they can get on the smith's anvil. *Some* bars of steel, and steel for *some* uses, *will* be injured by the *same* treatment. When it is necessary or desirable to use the center of a bar of steel, and it is found to be in a coarse condition by reason of having been brought to shape and size by blows disproportioned to its cross-section, there is, perhaps, no better way of improving the grain at and near the center of the bar than to upset, and alternate the upsetting with work from the outside of the bar.

Upsetting is not a cheap, easy or desirable thing to do, and is not likely to be resorted to often except when necessity compels, but I see no use in making a bugbear of it when, if properly done, there is no harm in it, and in some cases actual good is done by it. It does not at least break up the center of the bar, as blows at right angles with its axis often do; and after seeing, as I have, thousands of good cutters made by upsetting, for uses requiring the utmost soundness and best condition of steel, I don't like to see the process tabooed without saying a word in its favor.

Work Done by Wabash Locomotives.

Through the courtesy of Jacob Johann, superintendent of motive power of the Wabash, St. Louis & Pacific Railway, we have received a copy of the report of locomotive performance on the road he is connected with, for the year 1884. In operating the 3,546 miles composing the Wabash system 477 locomotives were kept in service. The whole equipment of locomotives is 591, which is one for each six miles of road. The engines in service made a total mileage of 19,015,294 miles which represents traveling more than seven hundred and sixty-six times round the earth. Each engine made over forty thousand miles during the year, which was a particularly high mileage when we consider that a large proportion of the locomotives were pulling freight trains. An analysis of the tables shows that about 25 per cent. of the mileage was done by passenger trains, and the remainder in freight, switching and construction work. The average size of the passenger trains was 4.76 cars, and the freight trains averaged 19.77 cars. As the heavy eight-wheel freight cars are used almost exclusively on this road the weight of trains was unusually high. Passenger cars were hauled at an average cost of 3.37 cents each per mile, and each freight car was pulled the same distance for 1.22 cent. The higher expense of hauling passenger trains is due to the light loads and high speed. The speed kept up is comparatively low or the cost of operating would be higher. The total cost per mile run was 17.73 cents. This aggregate is made up of 4.13 cents for repairs 0.46 cents for stoves, 5.59 for fuel, 6.35 cents for wages of engineers and firemen, and 1.19 cent for wages of wipers and dispatchers. The record is a very good one, and Mr. Johann has good reason to be proud of the work done by his department.

Small Universal Engine Lathe.

From the engravings which we present it will be seen that in the design of this lathe a radical departure has been made from the stereotyped plan of making small engine lathes—copies in miniature of larger ones. The construction is such that it will swing in line with the cutting tool as ordinarily used, a diameter about equal to what will be swung over the carriage of a commonly-constructed lathe of twice its nominal capacity.

As will be seen, the carriage may be run the entire length of the bed without coming in contact with either the head or tail-stock. The carriage is provided with a compound rest, which can be set at any angle, and which has direct vertical adjustment of two inches. Both the cross and angular feed screws of the compound rest are provided with micrometer heads reading to thousandths of an inch, the zero marks of which are adjustable to any fixed position of the slides, so that in many cases the micrometer arrangement may be used for sizing work instead of calipers or gauges, and at a good deal of saving in time. A T rest is furnished with the lathe, which is used in place of the compound rest when hand-tool work is being done.

The carriage is provided with every requisite adjustment for temporarily converting the lathe into a milling machine. If desired, a small milling machine vise is furnished, which can be screwed to the upper slide of the compound rest,

The lathe is provided with two leading screws, which are always ready for use, and are so situated as to be entirely protected from chips and dirt. One of these is a "precision screw," and is intended for use only for cutting fine and accurate screws. Both screws are geared alike, and will cut from 4 to 160 threads per inch, and from 8 to 80 per centimeter. The change gears are placed upon the stud and swinging arm instead of on the stud and screw, as is commonly done. When metric threads are to be cut, it is only necessary to substitute two *translating gears*—one on the screw and the other on the swinging arm—for those used for ordinary threads.

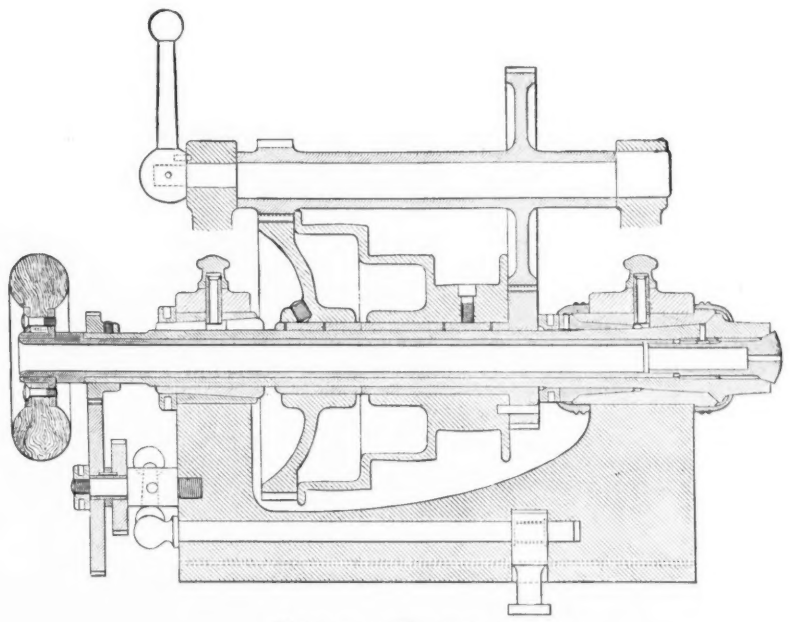
The lower part of the tail-stock is clamped to the bed by means of a cam; the upper part has a gibbed slide and clamp to set over for long tapers.

The lathe swings 7 inches over bed and carriage, and is made with various lengths of bed from 42-inch up. The hole through spindle is $\frac{6}{16}$ inch; largest hole through spring chuck, $\frac{4}{16}$ inch.

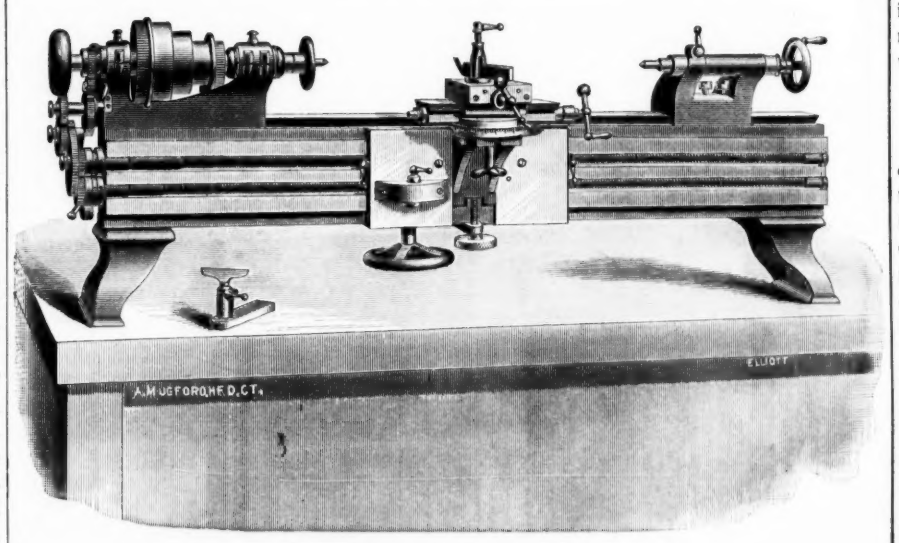
Larger spindles and chucks are made if desired. As will be seen from an inspection of sectional view, the spindle may be removed and another one substituted, or the boxes be replaced with others, without disturbing the running parts. In the sectional view the back gear is, for convenience, shown above the spindle instead of in its actual position.

The workmanship on these lathes is excellent. The spindles and bearings are hardened and ground, and nothing but scrapers used in fitting sliding parts.

The Ballou Manufacturing Company, Hartford, Conn., are the manufacturers.



Section of Headstock.



Small Universal Engine Lathe.

Explosion of Car Heater.

Recently, chair car 127, of the Cleveland, Columbus, Cincinnati and Indianapolis Railroad, fitted with a Baker heater, was partially wrecked, while running at thirty miles per hour, by the explosion of the reservoir of the heater, which is located on the roof of the car. This vessel is a cast-iron vessel about $\frac{3}{4}$" thick and 10" by 24" in outside dimensions. It is provided with a safety valve, consisting of a rubber disk with a brass stem. The rubber became hard and inoperative, and was the cause of the explosion. A hole about four feet square was blown through the car roof directly beneath the reservoir, pieces of which wrecked the heater proper, which was directly beneath the side of the deck, or clear story, and its roof was blown away, while the top and a portion of the side of the water-closet on the opposite side were also carried away, as were also two plate-glass windows, about four feet square, on the same side. The entire side and roof of the car were covered with a white coating of salt and water — the contents of the reservoir. The force of the explosion being downward and across the car, no one was injured, as that end of the car was fortunately unoccupied. This is the second accident of this kind on this road.

Scraps—No. 8.

By J. G. Tramis.

It is the aim of the inventor to make everything in the machine line as simple as possible, and the aim of the purchaser that it shall be so made, and yet a casual review of previous experience shows that in nearly every case the most successful machine of any class, if not the most complicated, is far from being the most simple.

The time was when time was kept by the hour-glass and sun-dial, with which no clock or watch of the present day can compare in simplicity. The time was when a knife was the machine for paring apples. The latest and best has bands, and pulleys, and cams, and racks, and cranks, and jimcranks.

The first steam engine was the simplest one ever built, and free from all objectionable features. The best one is the most complicated, has all the objectionable features, and some of them four times repeated.

The poorest turning lathe ever built was the most simple; the best one ever built, the most complicated; and so with nearly all machines and tools.

The hour-glass was not discarded because it was simple, nor the clock substituted because it was complicated, but because it performs functions and meets requirements that the hour-glass failed to meet.

The knife, as an apple parer, performed its function well enough, but was too slow. The latest power machine does all that could be done with the knife, at the rate of fifty bushels a day.

Call to mind the simplicity of the Hero engine as depicted by modern artists. A boiler set on a peg, two pieces of pipe with openings in the sides, and aside from a boiler feeder the engine is complete. Devoid of the steam pipe nuisance; no cylinder and piston to pack; no valve to leak; no gland to stuff; no crosshead to oil; no connecting-rod, which many have tried to avoid; no crank to squander one-third of the power, and many imagine it does; in fact, none of the things that are objectionable in the present engine; unfortunately it had none of the present engine's merits. To make the engine useful it had to be separated from the boiler, which added the steam pipe nuisance. To get power the engine had to run fast; to utilize the power it had to be geared down. High speed against atmospheric resistance and friction, wasted a large per cent. of the power, and friction wore out the journals, and wear called for repairs. It was the high speed problem carried to an extreme. The Hero engine, properly constructed by later mechanicians, failed to perform all the functions required of an engine. The modern engine, though every feature about it except the shaft and pulley are objectionable, is tolerated, in fact, even admired, for the duty it performs.

The primitive lathe, with two pointed spikes driven through blocks of wood for centers, a spring-pole string and pedal for a motive power, was simple compared to a modern engine lathe, but was restricted in the scope and quantity of work, as was the case with the original of the whole category of machine tools, textile machinery and all mechanical appliances.

While the casual review shows that the complicated machines have replaced the simple ones, a deeper study will show that it is only because they perform more functions, and when each function is separated from all others the mechanism which performs that function successfully is the best which is the most simple. The stem-winding watch takes the place of the key-winder, although it is far the most complicated; but taking the stem-winding element by itself, that is the best which does the work in the most simple manner, providing it is equally durable.

In the case of simplicity in the engine another element must be considered, and that is the element of friction. It is quite probable that the percentage of loss by friction in the Avery* Hero engine was greater than in many of our modern reciprocating engines, notwithstanding its two journals only, while the Corliss has its piston and rod, crosshead and shackle-bar, crank and main journals, eccentric and rod, swinging-arm and wrist-plate, four valves and their connections, and the governor and its gearing—about thirty working joints, all creating friction. With later improved rotary engines the percentage of friction runs immensely higher, and it is more than likely impossible to reduce the friction to anything like that of a modern slow-speed reciprocating engine. Simplicity does not always insure durability. A watch is in no sense a simple machine, and yet there are likely many 50 or more years old that have run pretty constantly, with a scape wheel that has made nearly a hundred millions of revolutions, and a balance that has made over four thousand seven hundred and thirty millions of oscillations.

Simplicity does not always imply a low first cost; in fact, it has less to do with low first cost than quality of materials or workmanship. A measuring machine, with a half dozen pieces, may easily cost more than a lathe with a hundred, or a loom with a thousand pieces.

Atlanta, Ga., is in a high state of dissatisfaction at the condition of her water works. The chief of the fire department has been notified that he must not depend on the water works in case of fire. The pressure is cut off from the mains several hours each night, and the citizens feel as if they have no water supply.

Richmond Mechanics' Institute.

We have repeatedly mentioned the Mechanics' Institute, of Richmond, Va., and the good work it is doing for the cause of industrial education in the city where it is established. Private citizens, public corporations, and the State authorities have all striven to give aid and encouragement to the institute, and it appears to be now in a flourishing condition. By the *Richmond Mercantile and Manufacturing Journal*, which has been a warm friend of the institution from the beginning, we learn that there has been a permanent organization of the Mechanics' Institute effected. We believe the industrial prosperity of Richmond and the State of Virginia will be promoted by the training which the ambitious and self-helping mechanics will obtain in the establishment just put on a solid foundation. Our greatest regret is that individuals and corporations in other parts of the country display so little desire to help workmen to obtain the education requisite to raise them to the higher branches of their business.

The Central Railroad and Banking Company of Georgia are now engaged in putting spark-arresters on one hundred and twenty of their locomotives, at Macon.

Not the least interesting of the letters from members-elect of the 49th Congress presented in these columns, two weeks ago, were those from the South. There is a strong and growing sentiment in that section in favor of protecting American labor and industry by a judicious tariff. Maryland, Virginia, West Virginia, South Carolina, Alabama, Florida, Louisiana, and, perhaps, other Southern States, send representatives to the 49th Congress who favor protection. And the protection sentiment in the South grows stronger every year.

*The American patent for the reaction engine was granted to Wm. Avery 50 years ago.

Duplex Railway Car Ventilating Apparatus.

The middle parts, *A* and *B*, in the annexed engraving show a plan of this ventilating apparatus as set on the top of a car. *A'* and *B'* are sectional views of the device, and they show the parts in position. In the view *A'*, *a* is a quadrant for regulating the position of the deflector *b*, and *c* is a small valve that closes in the part acting as an ejector, as in *B B'*.

The Duplex railway car ventilating apparatus consists of two galvanized iron trunks, 8 inches high, 12 inches wide, and about 5 feet long, placed at both ends of a car, in the clear story or monitor deck, passing out at openings made by removing the sash from the last windows on either side, and terminating in bell-mouthed elbows, tapering out to an opening 12 inches square.

The elbows point in opposite directions, thus enabling the air to pass in and through the trunks, regardless of the direction in which the car may be moving.

At the center of each trunk, on the upper side or top, there is an opening 10x20 inches, covered by a finely perforated metal screen, which slides into its position in grooves, and immediately below this is hung a deflector, attached at one end to a spindle operated by a lever at the side, arranged with a quadrant on the other side of the trunk, enabling any one to set the deflector at any angle.

The deflectors, being hung in opposite directions, one always acts as an injector while the other always acts as an ejector, both being in operation at the same time; and one being placed at either end of a car, the fresh air always enters at the front end, while the vitiated air always leaves at the rear end of the car, regardless of the direction in which it may be moving.

The deflectors are so arranged that there is always an opening of a half inch at the upper end, nearest the top of the trunk, and an opening of 1½ inches at the lower end. These two openings permit the dust, cinders, rain, or snow to pass through the trunks unobstructed. The upper, or half-inch opening, permits this passage, while the device is acting as an injector of fresh air; and the lower, or 1½-inch opening, acts as an inducing current, when the device is acting as an ejector of vitiated air.

As the trunks are 8x12 inches, the deflectors, when set at their maximum—6x12 inches—inject and eject at the same time a column of air 6x12 inches, each running foot which is $6 \times 12 = 72 \times 12 = 864$ cubic inches, or the one-half of a cubic foot, the movement corresponding to the velocity with which the car may be moving.

The average speed of an express train we will consider as 40 miles an hour, and at this speed the car moves $88 \times 40 = 3{,}520$ feet per minute—say 3,600 feet in round numbers.

When the deflectors are thrown into a horizontal position, they cover and thus close the screened openings at the tops of the trunks, and the air passes into, through, and out of the trunks without any action upon the air in the car. But if the deflector at the forward end be thrown down to its maximum, 6x12 inches—of the 8″x12″ column, enter the car through the screen, while only 2x12 inches pass off at the top and bottom openings, and as this 6x12 inches is the half of a foot, it follows that about 1,800 cubic feet of air pass into the car per minute at a 40-mile speed.

If, at the same time, the deflector at the rear end is thrown down to *its* maximum, the 1½-inch opening at the botton acts as an inducing current, causing a suction upon the car of 6x12 inches, and thus it follows that about 1,800 cubic feet of air are ejected from the car per minute at a 40-mile speed.

Every inch the deflectors are moved up decreases their action 300 cubic feet per minute, hence the action at 6x12 being 1,800, is at 5x12 reduced to 1,500—

4x12	reduces their action to		1,200	cub. ft.
3x12	"	"	900	"
2x12	"	"	600	"
1x12	"	"	300	"
½x12	"	"	150	"
¼x12	"	"	75	"

—per minute at a 40-mile speed.

An ordinary passenger coach is about 8×9 feet = 72 feet, and about 60 feet long = 4,320—or in round numbers contains, say, 4,500 cubic feet, and has a seating capacity of about 60 passengers.

Good ventilation under ordinary circumstances calls for 5 cubic feet of air, in and out, per head per minute—or, say, 300 cubic feet of air in all per minute for 60 people. This the apparatus will handle when set at only 1x12 inches; but if the car has a large stove at either end, heating the air up into the nineties, 600 feet might be very desirable per minute, or perhaps even more. This the device provides for by simple adjustment.

In very warm weather, with the outside temperature at 90° or over, even 1,800 cubic feet in and out per minute would not be objectionable, and when the apparatus is handling this quantity, free from dust and cinders, there would be no perceptible draft, as the movement of the mass of air in the car would be only 24 feet per minute, or less than 6 inches per second, while the 4,500 cubic feet of air in the car would be entirely changed every 2½ minutes—$1{,}800 \times 2\frac{1}{2} = 4{,}500$.

In cold weather, with the outside temperature at 32° or lower, the deflectors may be set at any point to produce a desirable temperature in the car, governed by the heating capacity of the heaters and the outside temperature, acting as they do at any desired point from 75 to 1,800 cubic feet per minute, at a 40-mile speed, or at any point between 75 and 900 feet at a 20-mile speed.

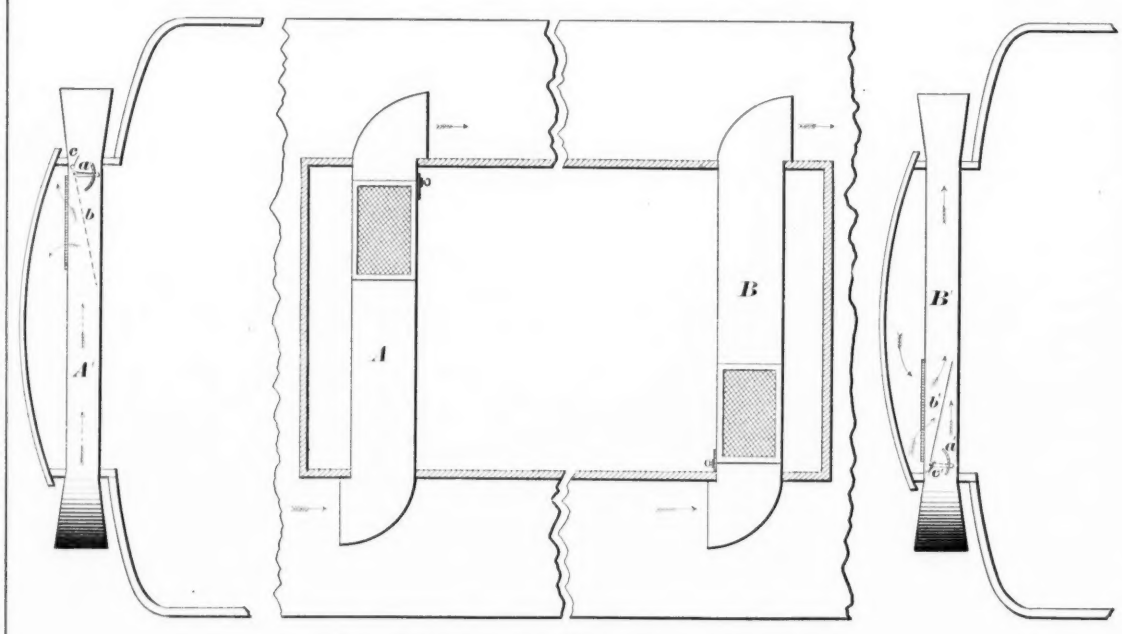
The apparatus being constructed entirely of metal, is comparatively indestructible, and, as there is no friction at any point, there is no wear and tear. As there is no machinery, it requires no attention other than setting the deflectors. The entire cost of production and placing upon an ordinary car does not exceed $50, and it can be made by any one who understands working galvanized iron, and can be put up by any carpenter. The trunks being made each from one sheet, there are no seams except on the top edges; hence, if care is taken in making a tight joint at the elbows, no water can possibly enter the car.

Mr. Groesbeck informs us that the device has been in daily use upon a large smoking car upon the Erie Railroad for the past 15 months, and that it has required no repairs during the entire period, and is in as good condition to-day as when first put on.

If the device has all the merit Mr. Groesbeck claims, it must, when known and understood, come into general use by all railroad companies who have the comfort of the traveling public at heart, to say nothing of the great saving to the upholstering in the car, by reason of the total exclusion of dirt and cinders.

Its small first cost, and the ease with which it can be applied, will assist in commending it to the consideration of railroad superintendents.

The inventor is David Groesbeck, 823 Madison Avenue, New York.



DUPLEX RAILWAY CAR VENTILATING APPARATUS.

Directions to Those Purchasing Engines and Steam Pumps.

We clip the following "Instruction to Correspondents" from a recent catalogue of the Southwark Foundry and Machine Company, Philadelphia. They will be found of interest to those purchasing and using the class of machines mentioned, but who are not entirely familiar with the subject:

To determine the "hand" and direction of a horizontal engine, stand by the end of the cylinder, face the shaft and observe the *position* and *direction* of the main driving pulley, and class the engine as follows:

Right-hand engines have the main driving pulley on the *right* of the observer. Left-hand engines have the main driving wheel on the *left* of the observer.

Forward-running engines move the *top* of the main driving pulley *away* from the observer.

Backward-running engines move the *top* of the main driving pulley towards the observer.

In deciding on the direction in which an engine is to run, it is well to remember that forward-running engines are preferable, on account of the thrust of the connecting rod being received on the lower guides, which are always stiffer and better lubricated than the upper ones.

In ordering steam pumps, it is for the interest of the purchaser to inform us on the following particulars: For what purpose is the pump to be used? What is the liquid to be pumped—hot or cold, clear or gritty, fresh, salt, alkaline or acidulous? What is the maximum quantity of liquid to be pumped? To what height is the liquid to be pumped? To what height is the liquid to be raised by suction? What is the length and diameter of the suction pipe, and the number of elbows or bends in same? To what height or against what pressure is the liquid to be forced?

In setting up and running steam pumps customers will do well to be guided by the following suggestions?

Never use pipes of smaller sizes than those given in the table. When long pipes are used, increase the size to allow for increased friction. Run every pipe in as direct a line as possible, with no more elbows, tees, valves, etc., than are absolutely necessary. Observe the above suggestions, especially in regard to suction pipes.

Take every possible precaution to prevent leaks in the suction pipe, as a very small leak at this point will destroy the effectiveness of the pump. See that a full supply of liquid is always furnished to the pump.

Remember that hot liquids cannot be raised any considerable distance by suction, and arrange the supply pipe so that the liquid will flow into the pump when liquids of a high temperature are to be pumped.

A large suction chamber, placed on the suction pipe close to the pump, is always advantageous, and on long lines, or on pumps running at high speed, it is a necessity.

Trying by Contract to Cancel Law.

The Eureka Mower Works Company of Utica, N. Y., seem to consider that people having the honor and glory of receiving permission to toil for ten hours a day in their factory ought with cheerfulness yield up all the rights and privileges usually accorded to human beings in civilized communities. Among the rules this company compel their employes to subscribe to with all the forms of legal phraseology, are that: "No employe shall make any claim or have any right of action against the company for any injury he may sustain while in the employ of the company caused by carelessness or negligence of the company or its employes. All employes must give two weeks' written notice of their intention to leave, or in default of such notice shall forfeit ten days' wages." This is put in the form of a contract, which also makes the employe agree not to belong to any union or organization of workmen. People are fond of boasting about American freedom, and contrasting the condition of our workmen with that of the down-trodden drudges of Europe. We would like to hear of the particulars of a case where workmen in Europe are treated with less consideration for the inherent rights of humanity than the Eureka Mower Works Company try to extend to their employes. The contract which they make their employes sign does not abrogate the rights of a man to damages in case of injury, for our highest courts have decided this repeatedly. Nor would the contract of such a one-sided character bar a workman's claim for wages, should he give no notice of his intention to quit work.

How American Inventions Get Adopted Abroad.

One by one the mechanical conveniences devised by the ingenuity of our engineers are being adopted by the engineers of the effete Old World. The plan that is found so useful in large railroad yards of equipping the switching locomotives with a powerful pump to be used to help in extinguishing fires, has found German imitators. The shunting locomotives in the Prussian service, we are told, are to be provided with a fire-extinguishing apparatus, by which they can be converted into fire engines at a short notice. This arrangement has already been tried in a few cases, and has proved itself of so much service that it is now to be applied universally. In about ten years the arrangement will be called a German invention, unless our English cousins see their way to claim it as their own.

The Savannah (Ga.) *News* expresses the opinion that when ship-building is revived in this country, the industry will be transferred from the North to the South, and that Savannah and Pensacola are to be the great centers of this industry, because of their being close to cheap iron, coal and timber. It disposes of the argument that they lack men skilled in the art of saying that "men who have practical knowledge of ship-building would soon find their way to where the industry was established." As to the argument attributed to Maine ship-builders, that men can do from 5 to 10 per cent. more work in the colder Northern climate than in the South, it says: "It is probable that they could do about as much work in the South as in the North. It was said not many years ago that white men could not work in the cotton field. Fully half the cotton crop is now made by white labor."

Various Locomotive Improvements.

Frank C. Smith.

Many of the Western railroads are using, with the entire absence of hot boxes, what appears to me a new form of bearing. One of the forms used on tenders and cars is shown by cross-section in Fig. 1. The filling is cast in, and is simply a strip $1\frac{1}{4}$ inch wide and the full length of the brass. The filling is largely lead, with a trifle of antimony, making it about as hard as ordinary babbitt metal. Another form, shown in Fig. 2, which gives excellent results, is composed of two strips of $\frac{5}{8}$ inch section each, with about one inch space between them. In both of these forms the bearing strips extend about $\frac{1}{4}$ inch below the brass itself, and run on an average 9 months. I have seen a new sleeper with a solid brass or phosphor-bronze bearing heat red hot, which, when jacked up and the bearing changed for one of these, run perfectly cool. I never heard or saw one of these bearings run hot. There may be considerable in the composition of the filling, but as I know personally that these differ very widely—in fact, some being totally different—I think there is much in the *narrow* form of bearing. This I feel sure of, as I have seen truck brasses of the form shown in Fig. 3 run very hot, which gave up this habit when cut out to dotted lines, leaving the narrow bearing of solid brass.

The filling used in the former two sketches is a white metal, and cannot be more definitely described. I do not understand that either of these forms infringe any of the patented lead-lined brasses, as the first sketch was used before and during the war, when they were filled in the South with type metal, bath tubs, lead pipe, pewter tea-pots, etc., and through bad fits of mandrels on which they were cast the filling frequently extended below the brass casing, thus giving the lead a chance to squeeze out and make a fit. I at one time fired for an engineer, who carried strips of sheet lead, about $\frac{1}{8}$ inch thick and 2x5 inches in surface dimensions, on the engine. When a tender or car brass got hot, he would cool it off, jack up the box, and slip in a piece of the sheet lead, with A1 results, invariably.

I have been recently looking into the matter of weight on locomotive driving wheels, and I believe there are not ten engines in the United States which have sufficient weight on the drivers. That is, the engines of this country have too much cylinder power. Take any locomotive builder's catalogue, and the loads given which the engine can haul on a level, and it will be found that this load is very much less than the load the engine should haul when the power of the engine is calculated from the cylinders. I saw an engine a few days since, a 16x24 inch, with 38,000 pounds on the four drivers. On a certain very steep hill she could just haul nine cars. I claimed the engine was too light on the wheels. The master mechanic proved by figures that the engine could not pull any more. To settle the matter, an extemporized load of about four tons was added to the weight on the drivers, when the engine readily took up the same hill sixteen of the same cars.

Ask the technically-educated engineer what load an engine will pull, and he applies the ordinary formula and gets a result which is wrong. And it is wrong because this formula assumes that there is sufficient weight on the drivers. To get the approximate load an engine will haul, if she is of American build, the cylinders may be entirely ignored, for they are too large, and any figures based on the cylinders will disappoint the investigator when he makes an actual test. My remarks apply to an engine in ordinary service—that is, what she will do day in and day out—and not under some specially favorable circumstances. My investigations have convinced me that an engine may be depended on under the above conditions—which are the only practical ones—to exert a strain on the tender drawbar of one-sixth the weight, in pounds, on the drivers, and the necessary weight on the drivers to utilize the full power of the cylinders; and assuming, in all cases, an average pressure of 90 pounds per square inch on the pistons, which agrees in practice with the average pressure obtained when the engine is wide open and working full stroke, of nine engines out of ten, and I therefore make this pressure constant.

When D = diam. cylinder in inches,
S = stroke " "
90 = pressure per square inch,
W = diameter of drivers in inches,
Then

$$\frac{D^2 \times S \times 90}{W} \times 6\ 25 = \text{weight on drivers.}$$

If, of course, the average pressure increases or decreases, allowance for same may be made.

Fifteen thousand pounds per wheel is the limit on many roads, and unwisely so, I believe, for I have seen an 18x24-inch Mogul, with 56-inch wheels and 90,000 pounds on the six drivers, or 15,000 per wheel, slip the wheels on good track. The same engine, when chained to a heavy post on a fair day and clean rail, would, with the reverse lever in full stroke and with 150 pounds pressure on the boiler, when the throttle was pulled slowly wide open, tremble violently and finally let go entirely and spin the drivers round like a top. In this case an extemporized increase of load of 5 tons extra on the drivers made a difference of 5 cars in what she could haul.

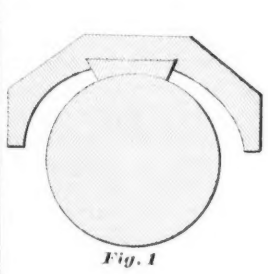


Fig. 1

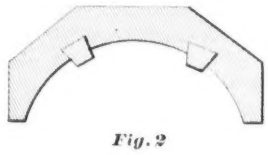


Fig. 2

Fig. 3

Fig. 5

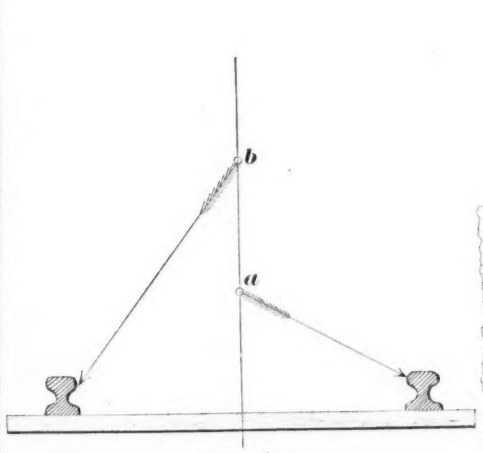


Fig. 4

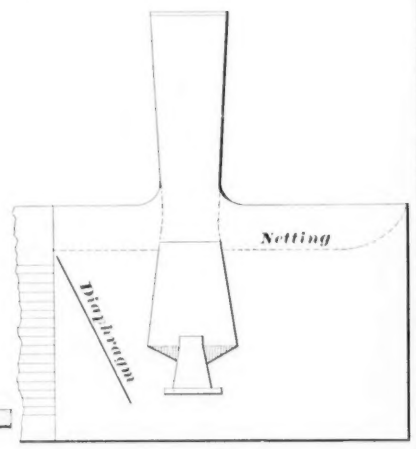


Fig. 6

It is frequently claimed that when 12,000 pounds per driver is exceeded, the track, joints, etc., suffer. The real facts are that the reverse is the case. Some years back I was connected with a road, the engines of which run from 10,000 pounds to 12,000 pounds per wheel. A new road was built, which was quite level, while the main line was very hilly. The new division was stocked with many of the main line engines, which were replaced with much heavier machines, the average weight per wheel of which was about 16,000 pounds, and it may be mentioned that the boilers were set much higher in the frames, thus raising the center of gravity. The result of a year's service of the heavier engines showed, from the road master's report, that the wear on the face of the rails had very noticeably decreased, while the master mechanic's report showed the wear of tires and their flanges to be much less. It was explained—and correctly so, I think—that the decrease of wear on the face of the rail was due to the fact that the heavier-loaded driving wheels slipped less, and consequently wore the track less. The same explanation answered for the decreased wear of the tires; and I believe the raising of the boiler decreased the flange wear of the tires, for the following reasons: If in Fig. 4, in which a represents the center of gravity of the engines, which is exaggerated in position to demonstrate the matter clearly, then a sudden lurch—caused, say, by a low joint, results in throwing the center of gravity of the engine nearly square against the side of the rail. This lurch is caught by the flange of the driver, and it suffers accordingly. In b, with the high center of gravity and the same lurch, the mass of the engine moves in a direction much more nearly on the top of the rail, and is not caught so much by the tire's flange. Whether this is a correct explanation or not, it does not change the facts.

An increase of weight on the drivers, and an elevation of the center of gravity, results in a much easier riding engine. The light engine appears to jump, for want of stability, like a piece of paper in a gale of wind. The heavier engine seems to be less affected, because it requires more to affect its heavier weight. Raising the boiler makes the engine ride easier, apparently, because it increases the leverage of the mass of the engine to resist inequalities.

I have ridden on both the high and low engines, over the same track and with the same train and speed, and the difference in favor of the high engine is very noticeable.

The wear of tires I believe to be greatly affected by the weight on the drivers, being increased on the lighter engines. I placed a revolution counter on a 16x24-inch engine, having 60-inch drivers, with about 40,000 pounds on the four drivers. This engine was coupled to a heavy train, and was tried on a measured piece of track on a hill of 12 miles in length. The distance the engine moved through in one revolution was obtained by marking the tire and rail, and then pinching the engine ahead one revolution, and until the mark on the tire came squarely down on the rail again. The distance between the marks on the rail was what the engine moved through in one revolution. This distance was multiplied by the number of revolutions, as shown by the counter, and gave 13.8 miles. Thus, although there was not a perceptible slip in the entire 12 miles, the engine had imperceptibly slipped 1.8 miles. A steel-tired passenger car wheel frequently makes from 400,000 to 500,000 miles, and I believe this high mileage, and the comparatively low mileage of a locomotive tire, is due to the fact that the former merely rolls along, while the latter, for want of sufficient weight, largely slips along. It is true that the car wheel has but about half the weight to carry that the locomotive tire has, but as a full offset to this it must be remembered that the car wheel is but about half the diameter of the locomotive tire, and consequently its entire surface comes in contact with the rail twice as often as the locomotive tire, and what it gains in carrying less weight it fully loses in its increased revolutions.

I had to make some changes in an engine with diamond stack, lately, to better her steaming qualities, and I tried a simple experiment with good results. Several years ago, when I was operating the tail-stock of a small lathe in a jobbing shop for an existence, I had given me by a farmer a shot-gun barrel to "choke." This was explained to me, and consisted in boring a recess about $\frac{1}{32}$ inch deep and $\frac{1}{2}$ inch in length in the bore of the gun, 3 inches from the muzzle. Before the operation the gun "scattered" badly; afterward it would lodge its entire load in a space of 10 or 12 inches. The engine in question "crossed" her exhaust badly, and did not do well any way. The angle of the nozzles was, of course, wrong, but was corrected, and the steaming made entirely satisfactory with $3\frac{1}{4}$-inch nozzles in place of 3-inch, by this means. A petticoat pipe was made of the shape and dimensions of Fig. 5. The one it replaced was 12 inches diameter. The "choke" on this pipe was 3 inches long and $\frac{1}{2}$ inch deep. The engine a 17x24-inch, 5-foot wheel. I am impressed with the apparent similarity of the straight stack and nozzles of the extension to the ordinary injector. Thus the stack represents the delivery tube, the petticoat pipe (if used) the combining tube, and the nozzles the steam nozzles of the injector. I intend trying, soon, to test this theory (the arrangement shown in Fig. 6), and will give you the results. I have some doubts about the necessity of the netting extending from the lower end of petticoat pipe to the nozzles, and don't feel sure that the baffle plate will be necessary if the petticoat pipe is used.

LETTERS FROM PRACTICAL MEN.

Brown's Method of Boiler Making.

Editor American Machinist:

Some time ago I gave your readers an account of "Brown's Way of Putting on a Dome," and promised to give you some more points in regard to the old man's methods; but, although I have paid a number of visits to his shop since that time, I have learned nothing really new until this week, and then I learned how Brown put in his tube heads—one in line with the other, and at the right distance to suit the length of tubes. Calling there on Monday, I found the old man very much excited and swearing at a fearful rate. Every one of the men—ten in number—were apparently paralyzed by the old man's loud and profane language. It seemed the old man had been absent for two days, and previous to his departure had taken his leading man into his confidence and given him instructions in regard to finishing a horizontal boiler which was in a great hurry; but as the leading man had been educated in a different shop and in a different method from Brown's, he didn't "catch on" to his theory as was expected, and a serious mistake was the result. My presence put a stop to his profanity, and after the old man cooled down he invited me into his office and gave me a statement in regard to the difficulty. I will give it in his own language as near as I can remember, and your boiler-making readers will possibly better understand it: "Before I went away I called Joe—that lunkhead out there—into the office, and told him just what I wanted. I had the shell of the boiler all punched and rolled up. I told him to put in one head, mark it off and punch it, then put it back in the shell, then put the shell on the rollers and level the flues with the spirit level; then make it secure in that position, put in the other head, level that in line with the other one, but before punching the holes in the flange to be sure and see that the flues would be long enough. This he could do by putting them in at different places to be sure everything would be right. I come home, and that infernal stupid had got one head riveted on, the other partly riveted up, and the seams are below the water line, and the flues too short by an inch. It's enough to drive a man crazy to have such men around you, and it seems as if I must do everything myself." The old man was called away at this time, and I thought

I would have a talk with Joe, and his statement did not exactly tally with Brown's. Joe says: "The old man told me to mark off the holes in the flange 2" from the back to the center, and I did just as he told me. He made a chalk mark on the shell which he now says he meant for the brackets, but I'll swear he told me it should be the top of the boiler. If you'd measure the shell you'd see it is too long any way. But that's the way he always does; makes big mistakes and then blames us fellows for it."

In the meantime the men were employed in cutting the rivets out of both heads, as they had to be shifted around to get the seams out of the fire, and when the old man came back he was pleased with their efforts, as he said, with a smile: "It does these fellows good to get a cursing once in a while."

In their desire to hurry the work along in the old man's absence, some of the braces had been put in and the holes cut in the shell, but Brown said he would put screw plugs in there which would not be noticed. As the men were hard at work cutting out the heads I left, and in the afternoon stopped there again to note progress. I carefully watched everything connected with the process, and think Brown is a very careful man, but lacking in figures. He put in the head just as he told me, leveled the flue holes with a spirit level, and then put in the other head; but when he put in the flue he could hardly believe the evidence of his senses. He carefully wiped his glasses and re-adjusted them, took out his rule and measured the flue, then measured the shell, and found that it would be necessary to cut off the holes in one end of the shell, and punch screw holes with a screw punch. He was angry all this time, and his looks showed it. All of the men stood around staring helplessly at him, and finally he told them in forcible language that as they had made such a blunder they must do something to repair it, and they must work that night without pay in order to get the boiler finished in time.

While the boiler was in its level position, Brown had the brackets put on, leveling them with the spirit level, and after marking off all the bracket holes, gave each one his particular job, swearing they ought to pay for the oil they used while doing their night task. Joe undertook to tell the old man that the shell was too long, any way; but the old man shut him up in short order by telling him he could get his pay at the office if he gave any more lip.

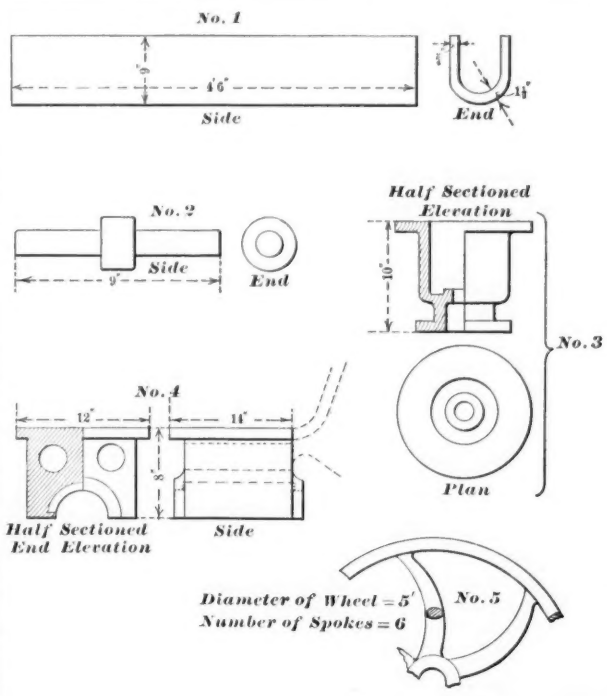
I walked away with the old man, and we parted at the corner; but I must confess my confidence in his ability was much weakened by what I had seen and heard that afternoon. I am going there again, and if I learn anything new I will inform you at the proper time. Ancient.

Standard Center Wanted.

Editor American Machinist:

For nearly four years I have read your paper. I should have taken it sooner if I had known that it existed. It fills the bill every time, and I only wish it was a semi-weekly. Sometimes I think the two events of the week to me are Wednesday and Sunday—one to get my paper, and the other to think over what I have read in it.

I wish somebody in this day of standards would stir up a standard center. In this town there are half a dozen shops, and twice that number of varying lathe centers. Sometimes it does not matter, but oftener it does matter a great deal. A machine was built by the Valley Works and has broken down, and parts are brought here and orders are given to stick to the thing night and day until it is done. Now, the Valley folks use a center of *about* 85°; ours are 70°. A shaft is put into the lathe and the centers ride on the bottom. If I stop to re-center the piece the proprietor grumbles about some men being altogether too nice for this Western country. If I don't stop to re-center the piece, about the time I get where I need a good center I find that the thing runs out, and won't stay oiled, or any other thing that it ought to do, and then the proprietor wonders how some men manage to stay in a shop more than a week.



I have worked with centers all the way from 55° to 90°, and, all things considered, I think I like 60° centers better than any other. Center.

Pattern Making at Purdue University.

Editor American Machinist:

Industrial education is at present a subject much discussed, and its importance is very generally recognized. To become best acquainted with its methods, one should inspect the workings of industrial schools; but since, as yet, such schools are few, many persons must gain a knowledge of them from published statements.

To give some idea of what industrial education may mean, I shall describe, with considerable minuteness, a portion of the work which is required of all candidates for a mechanical engineer's degree at Purdue University.

The course in pattern making continues twelve weeks, and embraces, daily, a one-hour recitation or lecture, a one-hour service in drawing, and a two-hour exercise in the shop. The object of the recitations and lectures is to develop that which in its widest sense may be called the theory of pattern making. They include discussions relative to the arrangement of the different pieces of which the pattern is composed; allowances for draft, rapping, finish, shrinkage, and warping, and the character of the pattern with reference to the way in which it is to be moulded; in brief, such phases of the art as can be practically considered in the class-room.

The drawing is principally devoted to problems developing the form and construction of patterns to give required castings. A blackboard sketch, with dimensions, or a carefully made drawing of a finished part, may be given, from which the student designs whatever is needed in the way of patterns and core-boxes.

The shop work in pattern making is preceded by adequate practice in bench work, turning and scroll-sawing, which gives the student the use of all the tools involved in pattern making; as further preparation, a few days are given to moulding and casting, in order that an understanding may be gained of the requirements of a pattern. Following the moulding, at least ten weeks are spent by each student in the construction of machine patterns. All work from drawings, and generally the work of each student, is different from that of his neighbor. In this way patterns are made in complete sets for complicated machines; the variety of work thus presented in a class of twenty, affords no small field of observation for its individual members.

To supplement the above, I add a copy of seven out of ten questions used in the last general examination on this subject, March, 20, 1884:*

1. Indicate by sketch, where and to what extent you would make an allowance on the pattern to secure a casting conforming, in form and dimensions, as nearly as possible, to that represented by No. 1.

2. A cylindrical casting is to be 8½" outside diameter, ½" thick, and 11' long, what, (approximately) will be its weight?

3. Sketch such a core-box as you would provide for making the core represented by No. 2.

4. Sketch the pattern and core-boxes necessary for the casting represented by No. 3.

5. Sketch the pattern and core-box (or core-boxes) necessary for the casting represented by No. 4.

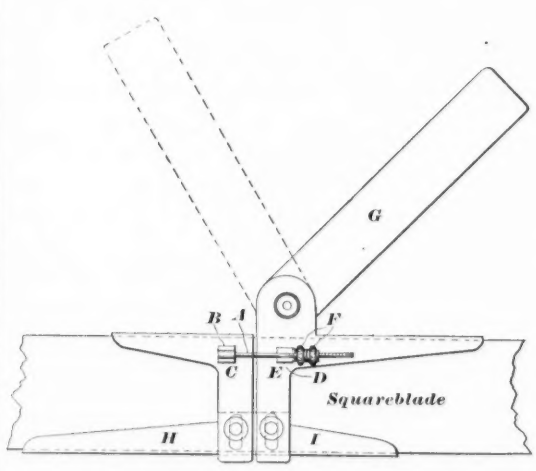
6. Sketch such appliances as will serve as a substitute for a complete pattern in making the mould for the casting represented by No. 5.

7. Make sketches showing the method of laying off the staves for a "built up" elbow pipe fitting, allowing five staves to the half pattern, and supposing the desired casting to be 10" in diameter.

It is proper here to repeat that the pattern making is preceded by a course in elementary wood work for fifteen weeks, and that the pattern-making occupies twelve weeks; and it may be added that the pattern-making is followed by a course in vise work in iron ten weeks, iron and steel forging eighteen weeks, and machine work in iron twenty weeks. In all of this work the student is guided by competent instruction.

W. F. M. Goss,
Professor of Practical Mechanics, Purdue University, Lafayette, Ind.

* The class for this year are, at this date, January 15, just beginning pattern making.



A Section Liner.

Editor American Machinist:

I have been a reader of the American Machinist since its first publication, and have obtained a great deal of useful information from it. In hopes it may be of use to some one, I send you a sketch of a section liner. I have never heard of one like it.

A is a piece of iron $\frac{5}{32}$" diameter, threaded on each end, one end screwed fast into *B*, which is soldered to *C*. *D* is a right angle piece soldered to *E*. It has a slot for the wire *A* to pass through, so it can be taken apart readily. The two milled nuts, *F*, graduate the space between lines. The blade, *G*, can be moved to any angle. The two pieces, *H* and *I*, can be moved to fit any width of square blade. It is made of sheet brass $\frac{1}{16}$" thick, and makes a very convenient tool. It is operated by the thumb and first finger of the left hand. C. H. K.

Steam Engineering Matters.

Editor American Machinist:

Judging from one of your recent editorials that some one of your numerous correspondents has been taking you to task for devoting too much of your space to steam engineering, I beg to differ from him, and agree with you in that respect. I think that anything that will help those having charge of steam plants to a better and more extended knowledge of the business will be of great benefit to them, and to the public at large, in tending to reduce the number of deplorable accidents that are constantly happening, many of which might, perhaps, be prevented by a more extended knowledge of the elements of danger that enter into this occupation. In this connection, I think the series of articles by Mr. Marshall on the construction and management of steam boilers have been particularly useful. I hope that the time is not far distant when every man having charge of a steam boiler will have to be examined as to his fitness for the place. This is particularly necessary in the case of portable threshing engines. I do not think that any class of boilers receive such hard usage as they do.

All kinds of water are used, they are rarely cleaned out, and are laid up at the end of the season without any care, often out of doors all the time, winter and summer. Running at a high pressure during the busy season, the great wonder is, not that they explode, but that there are not more accidents.

Where are all the flour mill engineers? I do not hear much from them through your columns. I should like to hear their experiences in regard to coal consumption, etc. Out here, where coal is high, it is quite an object to attain as high a degree of economy as possible under all circumstances. I have a 12×24 horizontal engine of an old pattern fitted with an Allen slide valve. The best that I can do is to average about 50 lbs. coal per barrel of flour. The engine is coupled to the main shaft running through the mill, and runs 86 revolutions. The mill is a combined roller and buhr mill—ten pairs of rolls and one run of 42" buhrs. We have to pump our feed water from the river, 610 feet from the mill, with about 20 feet lift. We use a Stillwell heater, which heats the water well.

I should like to hear some of your correspondents' experience with the Corliss engine, in regard to the valves keeping tight after they have run six months or a year.

A. B.
Redfield, Dakota.

Spring Rod for Flue Cleaner.

Editor American Machinist:

If Sterling Elliott will take steel of, say, $\frac{1}{4}$"×$\frac{3}{32}$" section, and wind it in a close coil about 1¼" outside diameter for flues from 2" to 3" diameter, long enough to suit his particular case, and attach any good scraper to the end, he will have something with which he can clean his flues from the fire-box. The steel should be wound flatwise—that is, so the greatest width is lengthwise of the spring.

A. W.

Flue Cleaner for Upright Boilers.

Editor American Machinist:

Allow me to help Sterling Elliott to a flue cleaner for his upright boiler. Let him make one as follows: Take a piece of ⅜" gas pipe about one foot long, and screw the scraper to it; then with this clean the flue as far as it will reach, and couple another piece to it and extend the cleaning, and so on. To withdraw the scraper, pull down and unscrew the sections. It is a little tedious, but I have used such a cleaner to advantage. R. Boisset.

Another Way to Clean the Flues of Upright Boilers.

Editor American Machinist:

If Mr. Elliott will take some pieces of ⅛"×½" flat iron, about 12" long, joint them together with rivets, and attach his flue-cleaner to one end, he will have a rig that he can work from the fire-box. H. U.

Repairing Blacksmith Tongs.

Editor American Machinist:

I was very much interested in the plan proposed by Mr. Hobart for new laying blacksmith tongs. It never occurred to me

before to do the job in that way, and it is new to all who have spoken with me about it, It seems so simple that it bears its value upon its face, and will be joyfully and generally adopted by the trade when its success is fully demonstrated. The old plan of cutting off the reins and welding on new jaws, although it made the tongs as good as new, required about as much time and trouble as would make a new pair, but I suppose it will still be followed for many years.

Jacob Vanderbilt O'Brien.

Tom Gets Promoted—He Makes a Square that isn't Square—How He Makes the Next One—Something About Soldering.

By James F. Hobart.

Tom has been promoted. He learned to chip castings and hammer his thumb. He did his first piece of "government work" by making himself a hammer, and now he has just spoiled his first iron with the bolt cutter, and his entire mind is bent upon making a square, while the back ground of the future is lined with visions of calipers, straight-edges and a surface gauge. Tom has got a piece of steel all ready, he has annealed it very soft, and is aching to begin his square. When he gets a chance, he marks out his square and begins to chip it out with a co'd chisel. It was slow work. "Guess I'll drill a hole in the corner," said Tom. A good idea; it worked so well that Tom kept drilling holes until the whole square was cut out.

What a time Tom had with that tool. He planed it all nice and smooth, rubbed it with file and emery paper, and wished he had a steel stamp to mark his name on it with. The first time Tom got a chance, he tried his square on old Tim's. What was the matter? Tom's square did not fit. It was open at the toe of the tongue when tried inside Tim's square, and "wasn't anywhere" when tried outside. Poor Tom. He stuck that square in his breeches pocket, sneaked back to the bolt cutter, and kept thinking the rest of that day. Tom worked out all his spare time on that square for the next two weeks. He filed, draw-filed and emery-papered until he was sick of it, and sick of squares too. It was awful work. Got the tongue so it would reverse on a line drawn across the planer bed, and Tom found the blade to be just a little "hollow," and by the time he got the blade in shape again, then the tongue was "out." Tom worked at the thing until the tongue got too narrow, and then he laid it up with his first hammer, which had a circle of fire cracks around its edge.

Tom was bound to have a square. He intended to have a good one too. He tried it again, and got three pieces of steel $\frac{1}{8}''$ thick and big enough for blade and tongue. The two pieces for the blade Tom planed, filed and scraped. The blade to this square was to be thicker than the tongue, and was made in two pieces, riveted together, and Tom worked them out the same width. He got the surface plate and made one edge of each piece fit thereon. He didn't trust file and emery this time, not a bit; he got a scraper and did his best to make twins of those two pieces of steel. They were tried together on the plate until they would stand up square, close together, until they were just of a width and could be changed end for end, bottom side up or laid down flat-wise without showing an error.

When Tom had done his best with the blade, he scraped the tongue true upon its flat sides, filed out the blade half the thickness of the tongue from each half, and scraped them to a fit. He kept trying together on the surface plate, and made the tongue stand true flat-wise. He fitted it so that it was a little less than 90° with the blade; then he was sure that no scraping must be done close to the blade, but whatever the error might be, it could be corrected at the toe of the tongue. Tom did't try to make the tongue as he did the blade, that is, parallel edges, and fitted into the blade just at 90°, or "square." He learned better than that when making his first square. After drilling the holes, reaming them, and riveting all together, being very careful not to "cripple" a rivet, or spring the blade out of true, Tom was ready to true up the tongue with the knowledge that the blade was *right* and nothing need be done to it.

Our Tom had arrived at the dignity of running the "Fitchburg Lathe." He puts a piece of iron cut from a 4" shaft, between the centers, and turns it as true as he knows how. He does his best to make both ends of that piece of iron the same size. When he can't make it any better Tom cups out one end of the iron, leaving $\frac{1}{16}''$ around the outside, cutting the center back so the iron will stand true on that end. Tom stands it on the surface plate and scrapes the outside of his square tongue until it is a fit. He tries that square all around that piece of iron and cannot find a single place where it is "out."

To true the inside of the tongue, Tom worked with the calipers, testing for straightness on the surface plate and trying the square on the turned iron, letting the blade extend across the end, or cupped portion, and fitting the tongue to the side. When that square was done, Tom could draw a line across a straight edge, turn the square over and draw again; draw two more lines along inside of the blade, and leave but a single line across the straight edge. It was a good square; Tom was proud of it, and every body knew it too. But Tom says the next time he wants a square, he will go to the store and buy one of Stubbs', or Brown & Sharpe's. If anybody catches him again working 82 hours on a square which he could buy for $2.50, then he hopes to be a candidate for a lunatic asylum, or a job in the navy yard.

There is fun in the shop when a big job of soldering is to be done. A soldering machinist is just about like the emery grinding chap. He is in misery, the solder won't run, it won't stick, and when one man burns his fingers in hot rosin, he can cuss a cowboy blind in two rounds. It is pretty work to soft solder when everything is right, and you know how. All you have to do, is to draw the iron along the seam, and the solder takes right hold as though it enjoyed it.

Lets see what is the matter with Mr. Machinist. He has got every thing he needs to do a good job, but that seam looks like a country road suddenly frozen in mud time. Lumps, bunches, much solder, no solder, a streak of rosin and a patch of dirt, is about the way that seam looks. Look at the soldering iron, a stunt, dirty point, covered with dross and ashes.

Get a "tinker" to use that kit; he would turn up his nose in disgust. Take the soldering irons (or "coppers" as they should be called) to a vise and file them into shape. About 60° is a good angle for the point of a tool, but special jobs may need other angles. Sometimes the point of a "copper" is so hard that the file will not touch it; this is caused by the union of the tin and the solder, and who knows but what the lost art of tempering copper can be recovered on this line. A certain degree of heat seems necessary to develop extreme hardness; it happens when the copper has been over heated, or burnt.

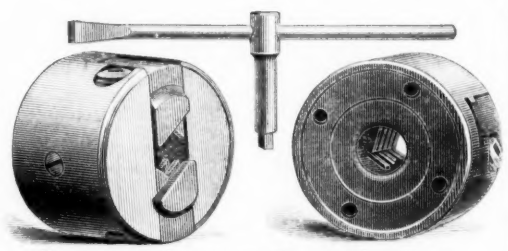
When the coppers are all filed shapely and clean, heat them just hot enough to soften a piece of solder. Melt a piece of rosin on a pale or soft burnt brick, and then melt a piece of solder in with the rosin. A rig of this kind works better after it has been used some time, for the copper will wear a hollow in the brick, which will keep the solder and rosin from running off the brick, and the rosin gets full of brick dust, which keeps the copper bright and free from oxide, so it can receive the tin. Two coppers at a time are easiest tinned; take one in each hand and rub them together in the melted rosin and solder. Don't have them too hot. Oxide of copper forms very much faster at a high temperature, than it does when barely hot enough to melt the solder.

Our man was trying to tin a red hot copper, and he made poor work of it; it would rust over as fast as he could file it, the solder burnt away, and the rosin turned into gas immediately. The old fellows used to tin a copper by rubbing on the ground, or dirt on the floor, then wiping on their breeches leg, and rubbing on a piece of tin with rosin and solder. Every time the iron came from the fire, the breeches leg operation came in play, and the owner thereof never thought more of it until an impromptu hole brought the victim to his senses with a singe and a howl.

The blacksmith's fire is a poor place to heat coppers, unless charcoal is used. The sulphur of the coal will take the tin from your coppers faster than you can put it on. If you have no charcoal, then put a lot of small blocks on top of the coal, and blow as little as possible. Don't heat coppers too hot; the right heat is attained when you can just bear the coppers within two inches of your face. Watch a tin-whacker change his copper for a fresh one; he rubs it on a wet rag to remove ashes, then holds it near his cheek and knows right off just how hot it is. Dipping the copper in a solution of sal-ammoniac helps the tin to adhere to the copper, and forms the proper flux for soldering copper.

Make a machinist understand that soldering is nothing under heaven but welding, and he will do twice as well at it. He would not expect to make a good job welding a 2" shaft without flux, and with $\frac{1}{16}''$ of rust between the pieces; yet he often tries to make solder run over dirty, rusty tin, without any flux but grease and ashes.

See that the parts are clean and bright. If tin or brass, use rosin; if copper, sal-ammoniac; if iron, use muriate of zinc, made by putting strips of sheet zinc into muriatic or hydrochloric acid until it will cut (dissolve) no more. The zinc is deposited upon the iron, forming, as far as soldering is concerned, a surface of zinc to work upon, and rosin should be used to protect the hot solder from the air. Large pieces of metal should be warmed before trying to solder them. Cast iron can be tinned by the acid, and soldered perfectly.



Westcott's Drill and Cutting-Off Chuck.

The machinist finds that with our clean, well-tinned irons and bright working surfaces, he can draw the solder just where he wants it. It will follow the hot copper just as iron filings follow a magnet, and the work looks smooth, bright, and clean. No lumps there. No muddy road business, either. Just nice work, and plenty of it.

If old work is to be mended, it must be cleaned before solder will "take." No use to wipe it off with the piece of waste you carry in your pocket. Take a scraper or an old knife, and surface the parts to be soldered. All rust *must* come off, and the acid be applied to those parts. Don't be afraid to scrape too much. A clean surface we must have, or the solder will "kick" every time.

Tallow is the proper flux for lead, but rosin can be used and will do a good job. Another point to look sharp after is the quality of the solder. Don't try to use pure lead, although the Chinese tea-lead contains so much tin that it will work very well. Good solder should be made of two parts tin and one part pure lead. Plumbers' solder for wiping up joints works best when reversed, viz., one part tin to two of lead.

Did a poor machinist ever so far forget himself as to try to solder a block tin or britannia teapot, which had a hole melted through the side thereof, then that machinist got himself into business right off. Tin melts at 446° Fahr., and his solder melts at 340°. His soldering copper is anywhere from 400° to 800°, and while he is trying to patch up one side of the hole, he melts half an inch from the other side. He does this two or three times; that teapot goes under the stairs, and the machinist takes a double chew of tobacco to soothe his rising temper.

The next time he tries the job he will fill the teapot with damp moulding sand, smooth it off the shape of the pot, mix two parts of bismuth with his solder, and it will melt at 236°; and he can use an iron much cooler than is required with the common solder. The hole can be melted full of solder, smoothed off, burnished, and Mr. Machinist can dig out the sand, show the job to "the boys," and carry it home in triumph.

Solder to melt at any required degree of heat can be made by varying the quantity of tin, lead, and bismuth.

TIN.	LEAD.	BISMUTH.	MELTS AT
			Dgs Fahr.
2	3	5	199
3	5	8	212
2	1	2	236
4	4	1	320
2	1	....	340
1	2	....	441
4	9	....	460
8	33	....	500
4	25	....	520
2	15	....	530
1	12	....	550

Westcott's Drill and Cutting-Off Chuck.

The engraving represents a new style of the well known drill and lathe chucks, made by the Oneida Steam Engine and Foundry Company, Oneida, N. Y. This chuck was designed to meet the demand for a strong chuck for holding drills up to 2" diameter, for holding boring bars, and stock for cutting up. It is made in two sizes, Nos. 3 and 4. No 3 is 6" diameter, and will hold stock or drills from 0 to $1\frac{1}{2}''$ diameter; No. 4 is $6\frac{1}{2}''$ diameter, and holds from 0 to 2".

It is strongly made, with straight body to bolt to face plate. No. 3 is 5", and No. 4 $5\frac{1}{2}''$ in length.

In order to adapt it, in special cases, for gripping especially strong and securely, two set screws are fitted in the body, situated at right angles to the jaws.

After centering and gripping with the jaws these set screws can be set against the work by the use of the same wrench used for setting the jaws. This gives a very secure grip.

The Legislature of Alabama has just passed a bill requiring locomotive engineers to be examined before they are given employment. The Governor of the State is to appoint five expert engineers, who shall constitute an examining board.

The engineers already having positions will be allowed a few days in which to make ready for the examinations, after which time if they fail to pass, they cannot legally obtain employment as engineers in that State.

The Russian Government have recently ordered 2,000 large Krupp guns. The immediate result of an order of this kind is to give work to a number of men, but in the end the price of the guns, as well as their maintenance, comes out of those who work to produce something useful. The more Krupp guns a nation requires the worse the condition of the producing classes.

Ever since the practice of electric lighting on an extended scale, the public has been periodically warned of the impending advent of a new storage battery that was to solve the question of the private use of "bottled electricity." At the present time it is an Auburn (N. Y.) man who has furnished the solution to the problem of an economical storage battery. But the public is skeptical, and will wait to see his invention work somewhere besides in the columns of the daily press before they believe in it. He uses, it is said, lead plates immersed in a solution of zinc sulphate, to which is added an alkaline solution, which prevents wastage of the plates.

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NEW YORK, MARCH 7, 1885.

CONTENTS.

	PAGE
Osgood No. 2 Excavator	1
Upsetting Steel and Iron. By S. W. Goodyear	2
Work Done by Wabash Locomotives	2
Small Universal Engine Lathe	3
Explosion of Car Heater	3
Scraps—No. 8. By J. G. Tramis	3
Richmond Mechanics' Institute	3
Duplex Railway Car Ventilating Apparatus	4
Directions to Those Purchasing Engines and Steam Pumps	4
Trying by Contract to Cancel Law	4
Various Locomotive Improvements. By Frank C. Smith	5
Letters from Practical Men—Brown's Method of Boiler Making—Standard Center Wanted—Pattern Making at Purdue University—A Section Liner—Steam Engineering Matters—Spring Rod For Flue Cleaner—Flue Cleaner for Upright Boiler—Another Way to Clean the Flues of Upright Boilers—Repairing Blacksmith Tongs	5,6,7
Tom Gets Promoted, etc. By James F. Hobart	7
The New York Railroad Commissioners and Car Heating	8
Fusible Plugs in Marine Boilers	8
The "Destroyer."	8
Literary Notes	8
Questions and Answers	9
Manufactures	9
Machinists' Supplies and Iron	10

The New York Railroad Commissioners and Car Heating.

We all know the miserable condition of existence awarded by the popular proverb to the canine whose patronymic has become subject to reproach. No kind of dogs in these latter days are so liable to incur a bad name as corporations. It is always a cheap and harmless pastime to abuse corporations, and the character of having zeal for the public welfare can be cheaply purchased by vigorously attacking the acts and shortcomings of a company that is not likely to make any defence. The patriots of New York State derive much comfort and no small amount of glory from denouncing the Elevated Railroad Company, yet the city would be in a most deplorable plight could the operation of these roads be stopped for a single day.

Among the curiosities of criticism to which the operating of these roads has been subjected, is a cry recently raised that the cars are over-heated. The party who started this alarm must have a temperament of body that delights in a cool, bracing atmosphere, for we have traveled regularly all winter in the cars complained of and never found their temperature above 70° Fahr. But the hound cry being started, there were plenty ready to echo it, and the shout has gone the rounds of the community, helped along by some of the daily press. It has also been taken up by one of the Railroad Commissioners of New York State, who has called upon the Elevated Railroad Company to amend its ways as to car heating, and has supplemented his request by a resolution calling on the railroad company to place electric lights along their track to prevent accidents during foggy weather.

The systems of car heating used on the Elevated railroads are by no means perfect, and the fact of the car doors being opened so frequently to admit or let out passengers makes maintaining an even temperature exceedingly difficult; yet, with all their faults, some of the systems applied to heat these cars are the best and safest used on any railroads in this country. The faults of the different methods of heating followed on the elevated railroads are faults of details, which the mechanical engineers connected with the roads may safely be left to perfect in the light of experience. It is very commendable to see the Railroad Commissioners of the State interesting themselves in practical railroad matters, but we certainly think they have chosen the wrong system of car heating to interfere with. During the last few months we have repeatedly drawn attention to the imminent danger passengers are daily subjected to by the presence of red-hot, cast-iron stoves in the cars of surface railroads. This danger has been repeatedly emphasized by the most horrible disasters known to railroad history; yet many of the railroads running trains in New York State use the primitive method of heating their cars that has destroyed the lives of so many human beings under the most harrowing conditions. If there is one conspicuous danger of our railroad operating during severe winter weather, it is the presence of this stove; and the Railroad Commissioners, who ignore its presence, are neglecting their duty towards the traveling public. This is not a case where no better means is practicable. The mechanical world has provided several methods of heating cars that are as efficient as the murderous stove without having its dangers, the only obstacle to their introduction being the question of expense. It is the urgent duty of the Railroad Commissioners to see that the question of safety is no longer ignored in the interests of mistaken economy. By investigating the methods of heating on surface railroads, they will draw public attention to a danger which ought to have been abated years ago. Under existing methods of car heating an Ashtabula or a Hamburg "horror" is liable to happen any day in New York State. Should any such calamity occur, the Railroad Commissioners would not be held blameless.

No man having practical knowledge of train operating would have proposed a line of electric lights to prevent collisions in a fog. If the lights were low enough to be of any use, they would blind the engineer by their glare. If an arc light could be placed on the platform of the rear car of each train, it might be of service. It is doubtful, however, if that would prevent collisions so effectually as an efficient block system.

It is doubtful if those in need of machine tools will ever be able to suit themselves both in quality and price better than just at the present time. While there is a good deal of business doing in this branch of machine manufacture, still it is dull in comparison to what could be done with the facilities at hand. Manufacturers fully appreciate the disadvantages of keeping a plant where 1,000 men might be employed running with 500, and, in order to induce sales and keep more men at work, have made prices remarkably low—lower, there is every reason to believe, than they will be a few months hence. In the time of good prices manufacturers, almost without exception, improved the quality of their products, and there never was a time when tools so good in quality and so low in price were in the market. Many machine shops that are getting along with dilapidated makeshifts should consider the advisability of relegating some of them to the scrap heap, and supplying their places while they can do so on such favorable terms.

Some years ago when ship builders began extending the length and reducing the beam of ocean steamers with a view of increasing their speed capabilities, very strong objections were raised to the change on the ground that the vessels would be too weak to successfully withstand the shocks and strains to which they would be subjected in heavy weather. These admonitions were not raised by amateurs, but by men of high standing in the maritime and engineering world. That their fears were ungrounded has been proved by the success and safety of the vessels built in the style objected to. A remarkable proof of the endurance of this class of steamship has just been given in the case of the steamship Alaska, belonging to the Guion Line. The vessel broke her rudder during the prevalence of terrible weather in mid-ocean, and during the remainder of the voyage she stood all the buffeting of the waves that struck her with destructive violence in her disabled condition, and passed through the ordeal without particular damage.

Fusible Plugs in Marine Boilers.

There is a United States law requiring that all steam boilers used in marine service shall have a fusible plug two inches below the water line. Most steam engineers agree that a fusible plug is utterly worthless as a provision against accident, and there are forms of boilers where it is impracticable to place a fusible plug to comply with the requirements of the law. It has been the custom of the supervising inspectors of steamboats in some parts of the country to pass vertical boilers without a fusible plug. Some time ago a steam yacht went from New York on a cruise up the St. Lawrence, and she finally came to anchor in the Buffalo district of marine inspection. The supervisor in charge there came across the boat and tied her up for violating the United States law by having no fusible plug in her boiler. The owner got his boat released after enduring some inconvenience, and the incident led to the question being brought up at the last meeting of the Board of Supervising Inspectors. The members of the board decided that they had no right to violate the law by granting certificates to vessels that had boilers in which no fusible plug was put in. If they were to stop granting certificates without pointing out some way in which the law could be complied with in the case of upright tubular boilers it would lead to great public inconvenience. They amended their rules respecting upright tubular boilers so that one now reads: "The plug might be inserted in one of the tubes at least twelve diameters above the lower tube sheet and at a distance not less than two inches below the lower gauge cock. Same plug may be inserted in the top tube sheet when, in the opinion of the local inspector, that may be desirable." This is one of the cases where antique United States statutes ought to be changed to prevent them from conflicting with the requirements of enlightened engineering progress.

The "Destroyer."

The Naval Committee of the Senate has, we think wisely, recommended the purchase of Capt. Ericsson's torpedo boat, the Destroyer. In fact, we think it is in a sense disgraceful that action in the matter has been delayed so long. The veteran engineer's previous achievements entitled him to more consideration than he has received in the matter. But Capt. Ericsson is essentially an engineer, and one of the hardest working ones in the profession at that, and if he understands the log-rolling methods so useful in getting recognition from our lawmakers, he despises them too much to practice them. Whatever he does stands or falls on its own merits.

Capt. Ericsson's system of torpedo warfare, as illustrated in the AMERICAN MACHINIST of Sept. 24, 1881, is simple and comparatively inexpensive. Perhaps these are its most objectionable features in the eyes of Government officials. It may or it may not be the best; this must be demonstrated by experiment. The Destroyer was constructed by the Captain at his own expense, and is now offered to the Government for the modest sum of $120,000, and the patents embodied in its construction for $100,000 additional. Further than this, Capt. Ericsson has offered to build for the Government, for $160,000, a vessel somewhat larger than the Destroyer, and to fully guarantee its performance.

The conclusion is almost inevitable that the day of enormous iron clads is past. In the near future they will be helpless against comparatively insignificant torpedo boats. In considering the naval question, which must be done at once, Congress will make a mistake if it does not give more consideration to torpedo warfare than has yet been done.

Sugar is the Jonah that has been chosen to be pitched overboard by the 49th Congress to stay the voracious appetite of the free-trade whale. But the modern Jonah is not as weak and submissive, when set upon, as the one in Holy Writ. He is liable to turn and wrestle with such promptness and vigor that some of the would-be pitchers are likely to find themselves dropped overboard and gliding into the maw of the hungry whale.

Literary Notes.

DYNAMO-ELECTRIC MACHINERY. A Manual for Students of Electrotechnics. By Silvanus P. Thompson, B. A. E. & F. N. Spon, 35 Murray Street, New York.

Prof. Thompson has been for years the leading authority on matters pertaining to electrical machinery. Few persons directly interested in electrical science have missed reading some portion of the Cantor lectures on Dynamo-Electric Machinery, delivered several years ago by the author of this book. The lectures treated the difficult subject in such a clear and comprehensive manner that it was not surprising an urgent demand was raised to have the work put in permanent form. This book is an outgrowth of the lectures referred to, but it is by no means a reprint. A large amount of matter has been added to the earlier part, which contains descriptions of all recent inventions of importance. The author's expressed aim has been to make the work a manual for students of electrotechnics, for whom no text-book of this branch of science has hitherto been available. His success has been so complete that the book is certain to prove of most valuable assistance to students,

and will, no doubt, take a prominent place as a hand-book of dynamo-electric machinery. The book will be of interest to others besides students. Engineers and other scientific men will find it interesting reading, and those connected in any way with the making of electric machinery will find the work a valuable reference for manufacturing directions.

The remarkable success of "American Foundry Practice," by Thomas D. West, which has gone through several editions, has prompted the author to bring out Vol. 2 of the same work. The publishers, John Wiley & Sons, 15 Astor Place, New York, inform us that the new volume will be ready about April 15th. It will be fully illustrated, and in addition to Mr. West's articles that have appeared in the AMERICAN MACHINIST, will contain considerable matter of value to foundrymen, not before published.

The first edition of "Locomotive Engine Running," by Angus Sinclair, was exhausted in a short time after it was ready for the public, but the enterprising publishers, John Wiley & Sons, took steps to have a second edition ready promptly, so that orders can be filled without interruption. The book sells at $2.00, and railroad men have been ordering 20 to 60 copies at a time.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(76) If J. P. B., Sterling, Ill., will give the number of revolutions per minute his shaft is to run we will answer his question.

(77) S. A., Bologna, Italy, asks: Has the Reese fusing disk for cutting iron been put into use in American workshops? *A.*—No.

(78) R. E. S., Cairo, Ill., asks: Where can I find instructions for laying down the theoretical curve on indicator diagrams? *A.*—In the AMERICAN MACHINIST of February 23, 1884.

(79) D., New Haven, Conn., asks: How can I arrange a lathe to cut coarser screws than the table indicates? *A.*—See illustrated article on this subject in the AMERICAN MACHINIST of Dec. 17, 1881.

(80) W. B., Mount Lebanon, Pa., asks: Does case-hardening make the hole of a nut larger or smaller, and is any allowance made in the size of taps? *A.*—Generally the nut will fit a little closer after case-hardening. No allowance is made in the size of taps.

(81) H. W., Easton, Md., asks: How many pounds of coal per horse-power per hour will be required in return tubular and locomotive type of boilers? *A.*—With coal of good quality, counting 30 lbs. of water evaporated per hour equal to one horse-power, between three and four.

(82) A. G., Fort Bennett, Dakota, writes: 1. I want to make a pattern, the diameter of which is 12 inches, with a core 9 inches in diameter. Shall I make the core-box just 9 inches, or shall I allow for shrinkage the same in the pattern? *A.*—Make the core-box just 9 inches. 2. Can I get the numbers of the AMERICAN MACHINIST for 1880 for $2.50? *A.*—Yes, for 1880, or for any year for which we can furnish them.

(83) C. C., Oglethorpe, Ga., writes: 1. I have a 9″x16″ engine, and a locomotive type of boiler. The boiler has been in use about four years. It is single-riveted, but well built and stayed. The shell is 5-16″ C. H. 1 iron; crown sheet, ⅜″ iron. It was guaranteed to carry 140 pounds of steam. The safety valve was set at 100 pounds, and about two years ago we set it at 90 pounds. We use good water, and the boiler is clean, with no scale or dirt. The stays and braces are sound; no leaks in the boiler anywhere. Am I safe at 90 pounds, or should I set the valve to blow at 80 pounds? *A.*—You neglect to give the diameter of shell and distance apart of stay bolts, without which no opinion can be given. The presumption is, from what you write, that the boiler is in about as good condition to withstand pressure as when new. 2. What can I gain with an automatic over a plain slide valve engine? *A*—The gain may be anywhere from 15 to 30 percent. in fuel.

(84) J. M. C., Philadelphia, Pa., writes: I have an engine 26″x42″; piston speed, 518 feet per minute; steam pressure, 70 lbs. The piston is fitted with three-ring packing, set out with springs and set screws. The outside rings are 2½″ wide, each, and ⅝″ thick, of bronze. The inside ring is 5″ wide, ⅝″ thick. 1. Is bronze a proper material for outside rings? *A*—Yes. 2. How much larger than bore of cylinder are such rings turned? *A.*—In this kind of packing reliance is placed on the springs to expand the rings, hence they are generally turned but little larger than the bore of cylinder, say about 3-16″ or ⅛″ in a piston of the size named. 3. Is ⅝″ a suitable thickness for the rings? *A.*—Yes. 4. Would it be safe to use the water from a jet condenser of a 500 horse-power engine to feed the boilers? *A.*—It is common to do so. When mineral oil is used in the cylinder we should not anticipate trouble.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Feb. 21, p 15.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

"How to Keep Boilers Clean." A book mailed ree, by James E. Hotchkiss, 86 John street, N. Y.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

$25 for 3x5 engine castings. Send for circular. W. D. Rich, 120 N. 6th Street, Philadelphia, Pa.

The Young Engineer's Own Book, $3. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

For Sale—26″ b. g. drill presses, quick ret'n bal. spindles, new, modern tools, $150. S. M. York, Clev'd, O.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Cooper, On the Use of Belting, $3.50. Edw. Meeks, Publisher, 1002 Walnut St., Phila., Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

A few chucks, of all kinds, for sale at half price. Slightly damaged. Send for list to the maker, A. F. Cushman, Hartford, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4.00; books for practical machinists. Address Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

MANUFACTURES.

W. S. Dorman & Company, Baltimore, will establish a screw factory.

Hoey & Marr, Jacksonville, Fla., will erect a corrugated iron workshop.

Arthur E. Boardman, Macon, Ga., will establish a machine shop at that place.

Cordell & Company, 169 North Street, Baltimore, will establish a tack factory.

George Mueller, 230 East 23d Street, New York, will build a four-story brick workshop, 25x33 feet.

The Canton (O.) Stove Works will start with $10,000 capital. A foundry will be erected 60x200 feet.

John Kent, 471 1st Avenue, N. Y., will erect a four-story brick workshop, 25x53 feet, to cost $4,000.

Ellin & Kitson, 519 West 21st Street, New York, will erect a three-story brick workshop, 75x128 feet.

Large machine shops are to be erected at Monroe, La., by the Vicksburg, Shreveport & Pacific Railroad.

G. A. Ainslee & Sons, Richmond, Va., are building an extensive branch carriage factory at Lynchburg.

An addition is being erected to the Union Foundry and Machine Company's Works, at Catasaqua, Penna.

The Pittsburgh Plate Glass Company, Tarentum, Pa., will enlarge their factory and build an additional mill.

The Cambria Iron Works, Johnstown, Pa, will build an addition to their Gautier Steel Works, to cost $80,000.

Warren Springer, Chicago, will erect a 28x80 foot building, three stories high, to be used for machinery salesrooms.

Wm. H. Ford, Lynchburg, Va., has purchased ground on which to build a large foundry, and also a wagon factory.

James Ostrander, Champaign, Ill., will start a new machine shop at Middlebranch, Kansas. It will be fitted with new tools.

The Perry (Ga.) Manufacturing Company have organized to manufacture curry-combs and other hardware specialties.

Elbel, Gilliam & Company, Canton, Ohio, will rebuild their iron works recently destroyed by fire. Estimated cost, $200,000.

The capacity of the machine shop of P. W. Lownes & Company, Orlando, Fla., will be doubled by the erection of new buildings.

The Agricultural and Mechanical College, Auburn, Ala., will put in machinery for practical mechanical work by the students.

Report says that the Birmingham Ala., Rolling Mills contemplate changing their works into a steel-making establishment.

The Pittsburgh Iron Manufacturers will demand a reduction to $4 per ton for puddling, at the next meeting to adjust the scale.

The Lowe Manufacturing Company, Pittsburgh, Pa., will put new machinery into their sewing machine factory at Rochester, Pa.

The town of Raymond, N. H., has appropriated $6,500 for the erection of a building to be occupied as a shoe factory by F. M. Hoyt.

Robinson, Rea & Company, Pittsburgh, Penna., whose machine shop was burned, will rebuild and refit at a probable cost of $60,000.

The Wadleigh Plow Company, whose works at Meredith, N. H., had been shut down several weeks from want of water, are again running.

McCormick & Bachman, proprietors of the Austin (Tex.) Foundry and Machine Shop, expect to make some additions to their plant.

The Co-operative Stove Foundry, Biddeford, Me., will soon erect an additional building, three stories high, and otherwise increase their capacity.

The machine shops of the New Orleans and Mississippi Valley Railroad will be located at Vicksburg, Miss. Work has already commenced.

W. W. Stewart, of Columbus, Ga., has purchased two acres of ground at Chattanooga, Tenn., and will erect a wood-working factory 35x100 feet.

The Davis sewing machine works at Watertown, which have been closed since the middle of December, are reopened, giving employment to 300 men.

George B. Christman, 331 East 55th Street, New York, will erect on Second Avenue near 63d Street, a five-story brick workshop, 25x85 feet, to cost $17,000.

The Gibson-Lee stove foundry, Chattanooga, Tenn., is to be enlarged, and the capacity will be doubled. The foundry will give employment to about 60 hands.

G. F. Pillings, 44 Granby Street, Baltimore, Md., will get out a new engine for electric lighting purposes (or for other uses), which will be in the market about April next.

The Arlington Mills Company, Lawrence, Mass., is about to enlarge its new cotton mill, by building an addition, which will increase its capacity from thirty to fifty thousand spindles.

Hoyle-Jones Manufacturing Company, Martin's Ferry, Ohio, manufacturers of threshing machines and farming machinery, will rebuild at once their factory recently destroyed by fire.

The Murfreesboro Machine Works, Murfreesboro, Tenn., are endeavoring to increase their capital with a view of putting in more machinery. J. S. Baird is Secretary of the company.

A movement has been started in Attleboro, Mass., to help unfortunate workmen there who have been long out of employment. Some $1,200 have already been subscribed for this purpose by the citizens.

It is announced that the Wilson sewing machine factory, at Wallingford, Conn., has been let to a New York stockinet manufacturer, who will occupy it for his own business, and employ 400 or 500 hands.

Bocherding & Company, proprietors of the Chattanooga Saw Works, are having a splendid new factory erected on Broad Street. The factory will be two story brick, 150x48 feet.—*Chattanooga Tradesman.*

The Porter Manufacturing Company, of Revere, Mass., has been incorporated to manufacture wrenches and other tools. Capital stock, $100,000. Daniel R. Porter, President; John A. Whipple, Treasurer.

The round-house and machine shop of the Burlington & Northwestern Narrow Gauge Railroad at Burlington, Iowa, was destroyed by fire. Three locomotives were consumed. The loss is $20,000 insurance $22,000.

The *National Labor Tribune*, of Pittsburgh, says, in its issue of February 14th: "The finished output of iron for the last six days is about 950 tons a day which is very little more than half for the corresponding time last year."

Notes of the starting of shops, mills, and factories that have been idle come from several parts of the country, but the starting is often accompanied by a reduction of wages. Activity does not always mean prosperity for manufacturers or workmen.

F. W. Richardson, Troy, N. Y., has issued an illustrated catalogue of the Richardson and the Richardson-Allen balanced slide valves, and of the Richardson relief valve, and model link and valve motion. Full descriptions of the balanced valves are given.

The Hazleton Boiler Company, 716 East 13th St., New York, are very busy. Their boiler is of a peculiar form, having tubes radiating from a central shell, the whole being enclosed by an outer casing. The boiler is reported as giving remarkable results in generating steam economically.

The A. S. Cameron Pump Works, 23rd Street, New York, have worked full time with a full force of men all winter. They have recently shipped quite a large supply of pumps to the Chicago, Milwaukee & St. Paul Railroad. They have a full exhibit of their pumps at the New Orleans Exhibition.

The Weed Sewing Machine Company, Hartford, Conn., manufacturers of sewing machines, bicycles, etc., has voted to reduce its stock from $600,000 to $240,000, and to ask permission from the legislature to issue bonds to the amount of $160,000, which may be converted into stock within five years.

Negotiations are going forward in Springfield, O., looking to the establishment there of extensive machine works formerly at Fulton, N. Y. A five-story brick building will be leased, and the concern will probably be ready to start in May next, with a force of between 50 and 100 operatives.—*Industrial World.*

The Pioneer Iron Works, Brooklyn, N. Y., have published an illustrated catalogue descriptive of the Zell water tube boiler, which they manufacture. In addition to descriptive matter, the catalogue contains instructive matter relating to horse-power of boilers, draught of furnaces, rules of engineering, etc.

James E. Hotchkiss, 86 John Street, New York, has issued the 13th edition of his pamphlet entitled, "How to Keep Boilers Clean," making 65,000 copies that have been issued, and sent free, in editions of 5,000, within the past two years. This edition has been enlarged from 72 to 88 pages; also revised. Send for a copy.

A. S. Jenkins, Brockton, Mass., who is one of the concerns outside of the Tack Manufacturing Association, is doing nearly three times the business now that he did at the same time last year. He has never been obliged to shut down, and is running 40 machines, with the full complement of other machines.—*Boston Commercial Bulletin.*

Mr. Filley, President of the St. Louis Malleable Iron Company, attended the Chicago meeting of the stove manufacturers and exhibited his cast steel stove plates. He is very much pleased with the manner in which his new invention was received, and is now getting orders and endorsements from the trade all over the country.—*Age of Steel.*

The Hagerstown Machine Company has organized at Hagerstown, Md., with Daniel Garver, president; Charles Negley, secretary and treasurer, and H. C. Foltz, superintendent; will occupy a building formerly used as an agricultural-implement factory, and will carry on general machine business. Capital, $28,000, paid up.—*Baltimore Manufacturers' Record.*

Sargeant & Cullingworth, 382 Second Avenue, New York, have been quite busy all winter making the Ingersoll rock drill, and other machinery. Last month they delivered ten straight-line air compressors, with all attachments complete. They are now making some heavy special machinery for the Standard Vapor Fuel Steel Company, who are building new works at Flushing, L. I.

The Dalton, Ga., *Citizen* thus speaks of the new cotton factory engine at that place: "The trial test of the cotton factory engine was made last Friday. It is a mammoth machine. The fly-wheel is about 35 feet in diameter, and the swing of the giant arm has a capacity of 200 horse-power. The looms and other machinery are being rapidly placed in position, with the view of beginning operations at the earliest possible moment."

The Columbus (Ga.) Iron Works Company have added to their boiler department a punching machine (recently illustrated in the AMERICAN MACHINIST) manufactured by Hilles & Jones, Wilmington, Del.; also a shearing machine from the Columbus, Ohio, Machine Company. Mr. John Connolly, of Cleveland, Ohio, has been placed in charge of this department. The foundry department of this company poured off 310 heats in 1884, making over 2,000,000 pounds of castings, varying in sizes from ¼ pound to 10,000 pounds.

Machinists' Supplies and Iron.

NEW YORK, February 19, 1885.

There is no change whatever in the condition of the supply trade.

Iron—The market for pig continues steady. Standard Lehigh Valley brands have sold in small lots, at $18 to $18.50 for No. 1 X Foundry at tide-water; $17 to $17.50 for No. 2 X.

Scotch pig continues dull and nominal. We quote for Shotts, $21.50 to $21.75; Coltness, $21.50 to $21.75; Glengarnock, $19.50; Gartsherrie, $20.50; Summerlee, $20.50; Carnbroe, $19—all to arrive.

Copper ingot has been quiet and steady. Jobbing sales of Lake have been made at 11 to 11¼ cents.

Tin—The Market for spot is firm, with moderate demand. We quote for jobbing lots: Banca, 18½ cents; Straits and Malacca, 17.45 to 17.55 cents.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Experienced and practical draftsman wants permanent position. Ad. "Square," AM. MACHINIST.

Situation wanted by an iron foundry supt. or foreman. Adddress Iron Founder, AM. MACHINIST.

Wanted—Experienced man to run roll grooving and grinding machines. Address T. W., care AM. MACHINIST.

Mech. engineer, of good address and experience, wishes to travel part time for good firm. Address Box 2, AM. MACHINIST.

An experienced engineer desires a position as chief draftsman or superintendent. Address N. S. S., AM. MACHINIST.

A position to travel with a line of steam goods by a man who has had ten years' experience, and can give unexceptionable references. Address Box 5 AM. MACHINIST.

Wanted—A first-class mechanic to take charge of our works as superintendent. Must thoroughly understand all kinds of bridge work. State experience. The Berlin Iron Bridge Co., East Berlin, Ct.

Wanted—Situation as foreman or salesman, by practical machinist of large experience. Have first-class marine engineer's license, and understand the erection of all kinds of engines and machinery. Address "Salesman," AM. MACHINIST.

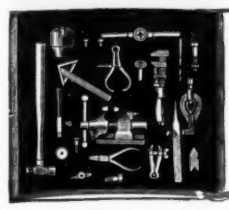
Wanted—Position as manager, superintendent or designer, by Mechanical Engineer who has had a technical education and ten years' practical experience in mechanical work and the above positions. Best references. Ad Box 15, AM. MACHINIST.

Wanted—Working supt. for shop making special high-class machine tools. Must have practical and progressive ideas; capable of handling his dept. to make money and be an accurate inspector of work. Address, giving age, past experience, references, and salary expected, Western, AM. MACHINIST.

Wanted—A foreman blacksmith; one who thoroughly understands engine and general machinery work—to take charge of a shop with 12 to 14 fires; must be sober, reliable, and pushing. None other need apply. To the right man steady employment can be given. Apply by letter, giving age, experience & references, to Drawer 130, Brantford, Canada.

Foundryman wanted as foreman or contractor. Annual melt 1,200 to 1,500 tons. Character of work largely agricultural, with some machinery castings. Best of references will be required. This application from a large concern not far from Chicago, and I believe it to be a good opportunity to the right party. Written communications only will be received. Address S. E. Bliss, 89 Lake St., Chicago, Ill.

50 horse-power Nagle portable engine, with all fixtures complete. Also 40 horse-power new economizer boiler—nearly new. Great bargains. S. L. Holt & Co., 67 Sudbury St., Boston, Mass.



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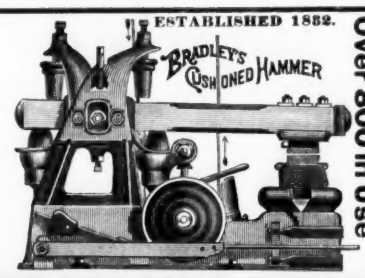
OF MECHANICS AND MANUFACTURERS.



BRADLEY'S CUSHIONED HAMMER.
Stands to-day without an Equal.
It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.
BRADLEY & CO., Syracuse, N. Y.

PROPOSALS for STEAM BOILERS.

Nashville, Tenn., Feb. 12th, 1885.

Sealed Proposals will be received by the **Board of Public Works and Affairs, Nashville, Tenn.,** until 2 P. M., March 10th, for furnishing and erecting at the present pumping station of the Nashville water works a battery of steam boilers complying with the following conditions and specifications:

The boilers are to have an easy capacity to evaporate eighteen thousand pounds of water per hour from feed water at 125° F. to dry steam at eighty pounds' pressure, using bituminous slack coal. They are to be, in every particular, first-class in design, material and construction, and will be held rigidly to fulfill the specified conditions, tests, and inspections. Each boiler is to be capable of separation from all the others, so as to be fired or cooled without interfering with the working of the others The stack is now standing (brick)—height above grate level, 100 ft. Area of flue, 20 sq. ft.

The city will furnish the raw materials for foundations, setting, and furnaces, except iron. All other materials, connections, safety valves, stop valves, blow-off valves, feed check valves, steam and water gauges and cocks, wrenches and furnace tools, as well as all labor and appliances necessary to construct, deliver, erect and connect the boilers in complete working order, are to be supplied by the contractor. No proposal will be considered which does not specifically state the evaporative rate which the bidder will guarantee with security, if awarded the contract. Such evaporative rate shall be construed as the number of pounds water evaporated from and at 212° F. per pound of *combustible*. The fulfillment of the guarantee will be determined by a three days' working test, using screened Hecla lump coal, with feed water at 125° F., steam at eighty pounds, and the results will be reduced to weight of *combustible* and evaporation from and at **212° F.** Bidders will state the *least* interval after award of contract in which they will complete the work.

Forms on which proposals must be submitted, detailed specifications, and comparative values of Hecla and other coals, will be furnished on application.

By order of the Board of Public Works and Affairs.

The Deane Steam Pump Co., HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
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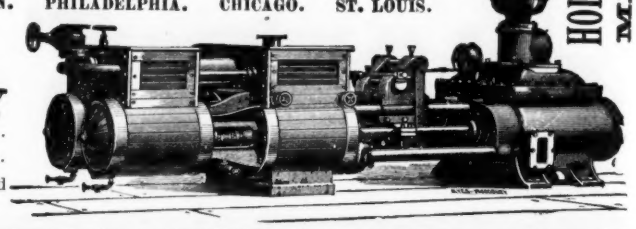

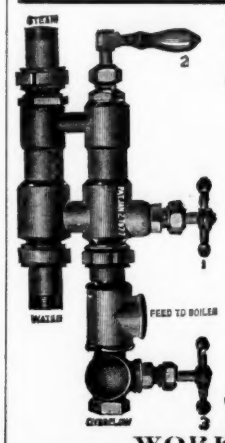

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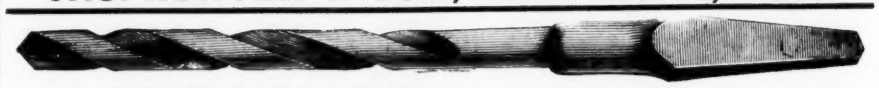

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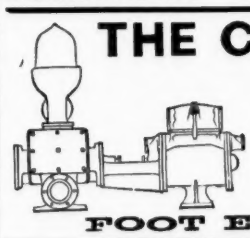

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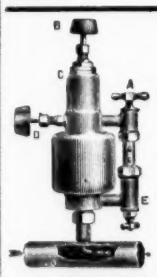

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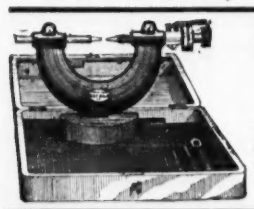

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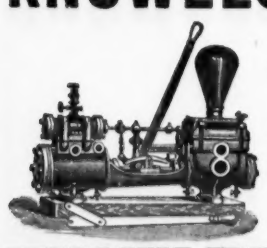

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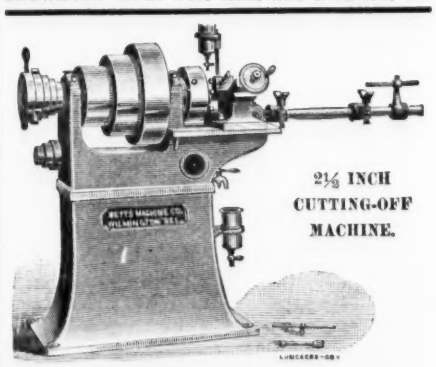

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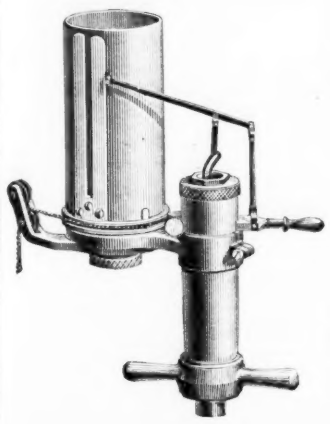

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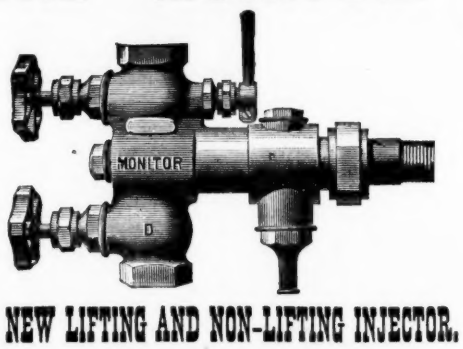

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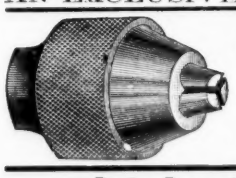

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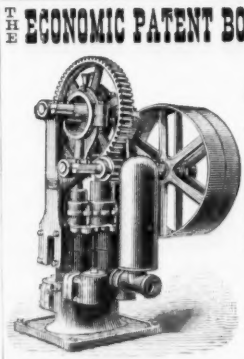

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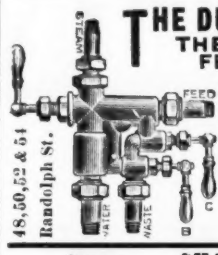

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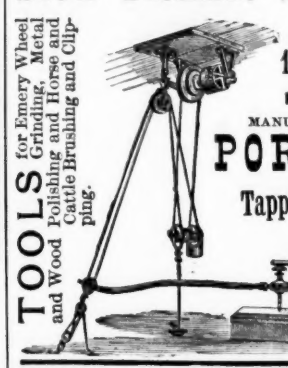

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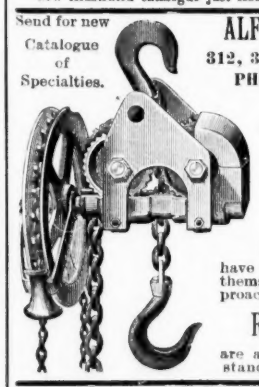

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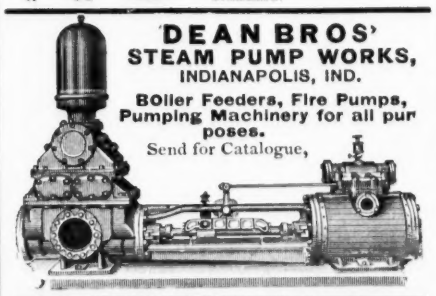

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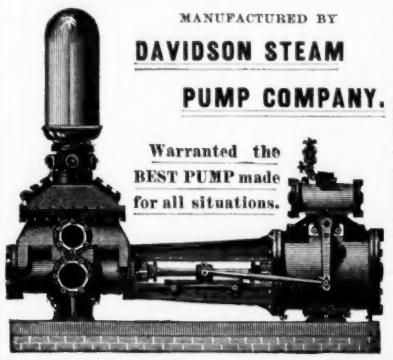

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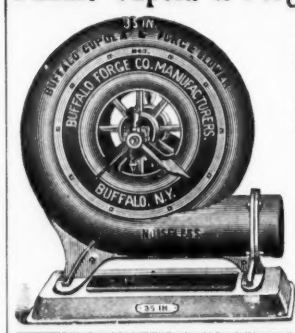

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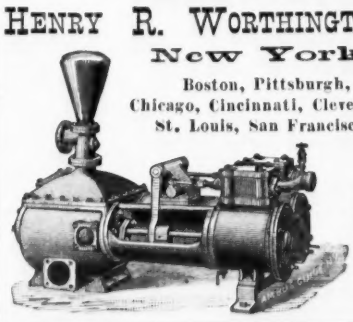

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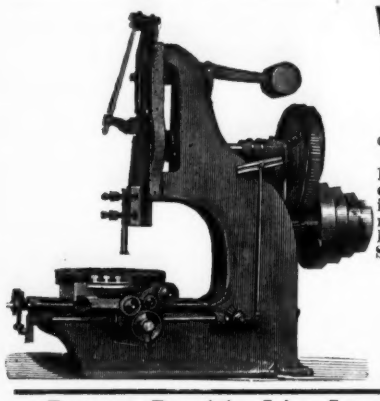

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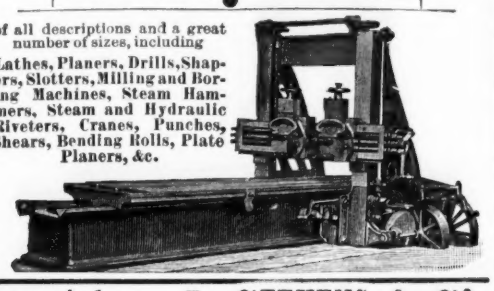

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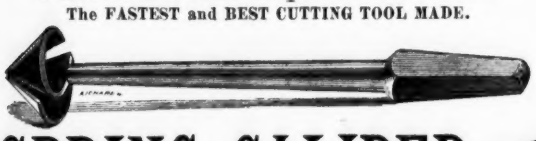

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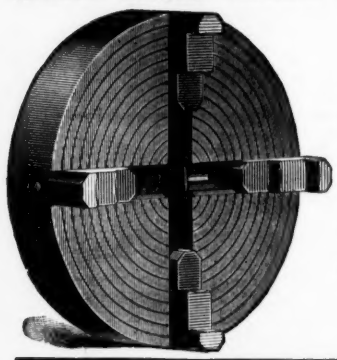

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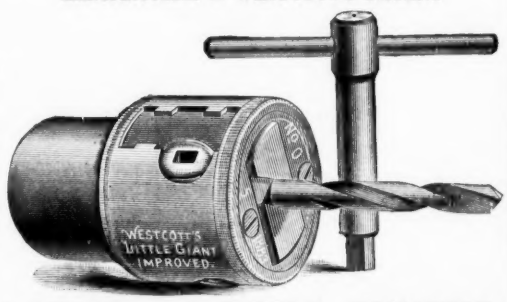

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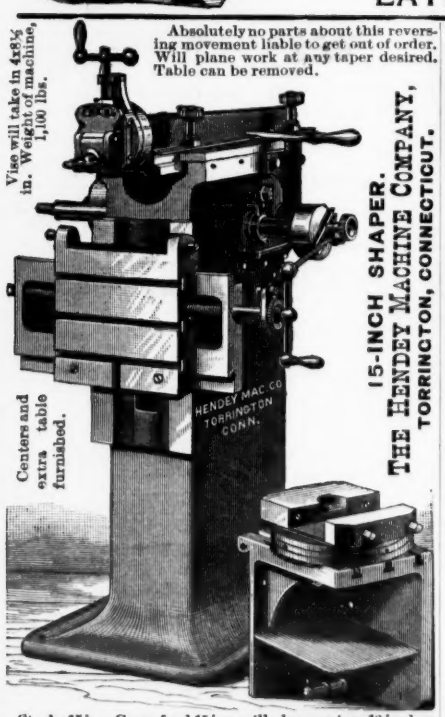

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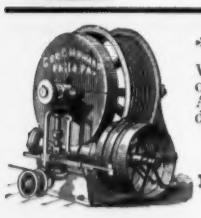

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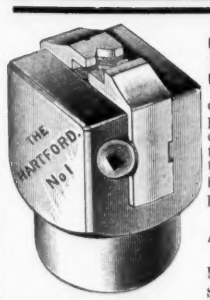

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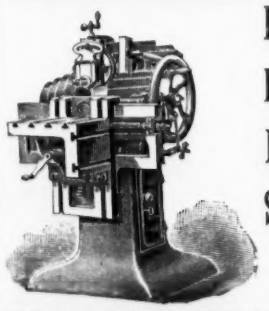

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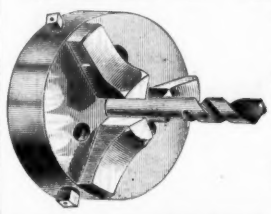

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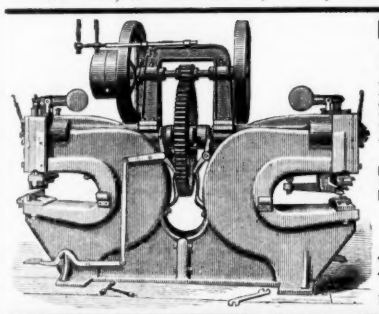

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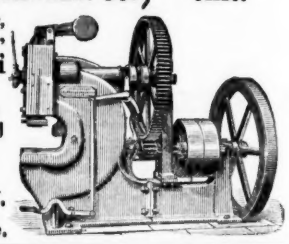

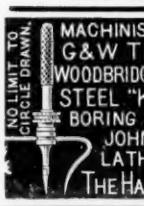

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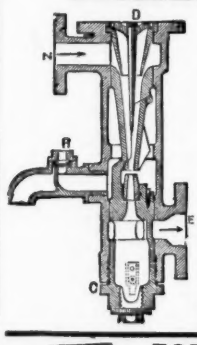

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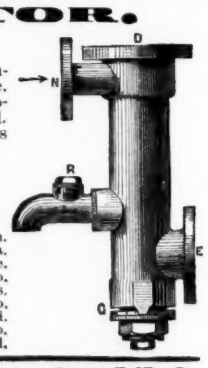

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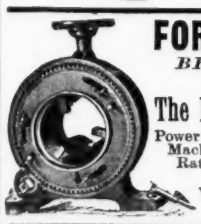

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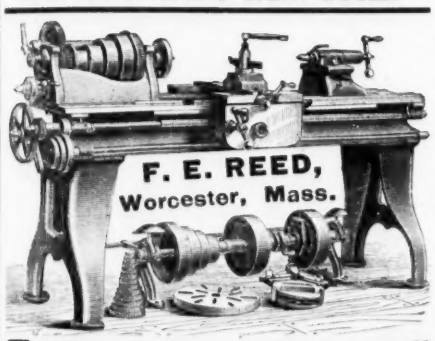

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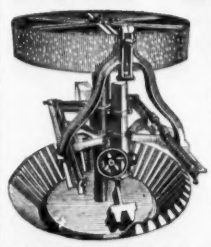

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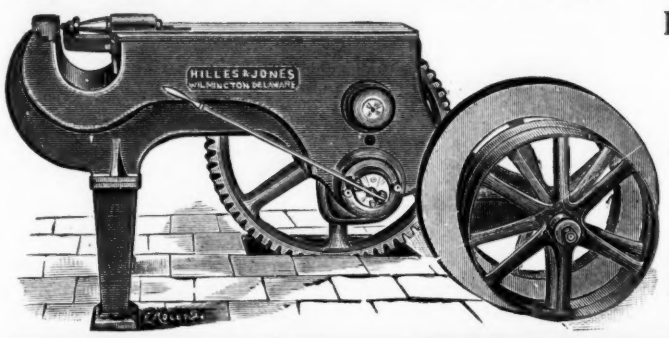

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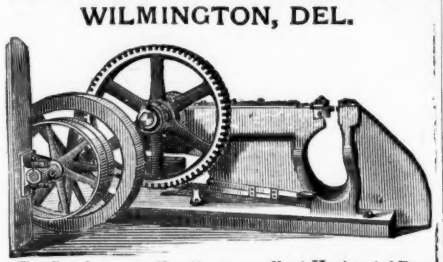

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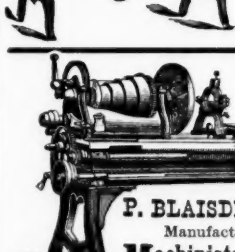

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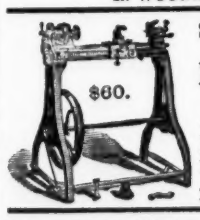

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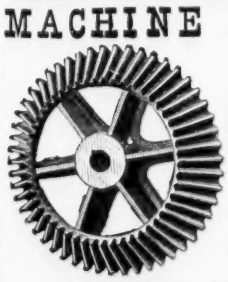

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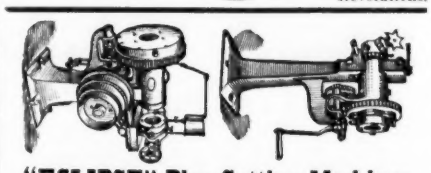

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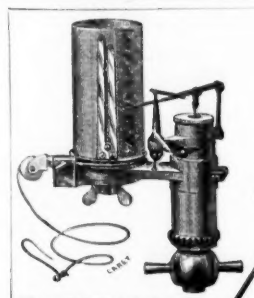

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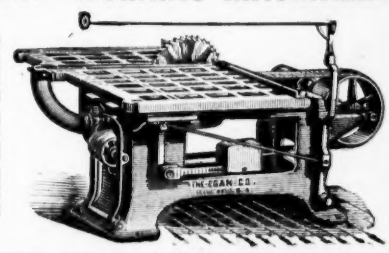

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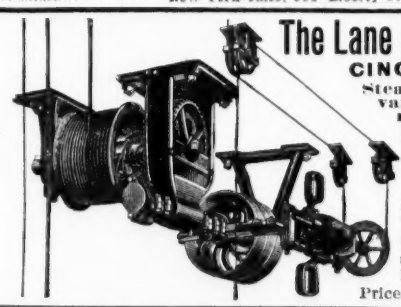

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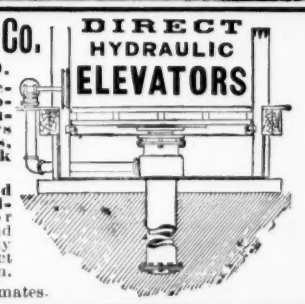

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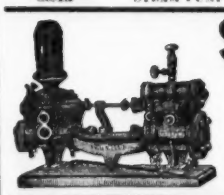

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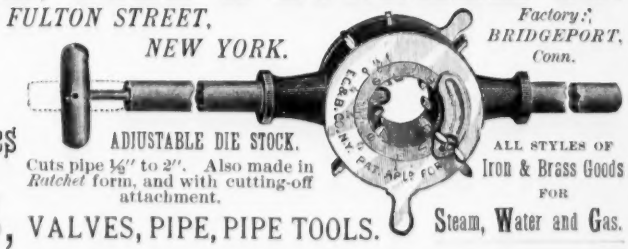

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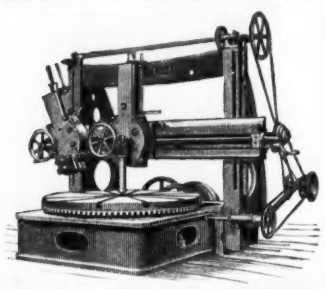

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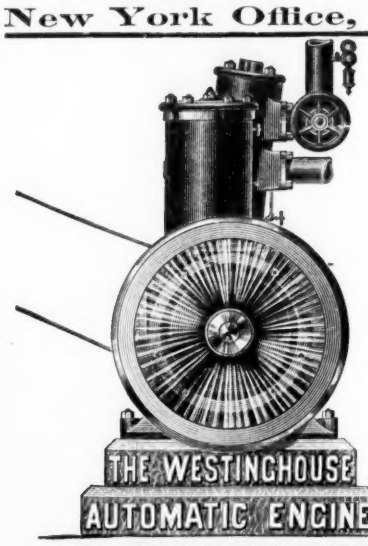

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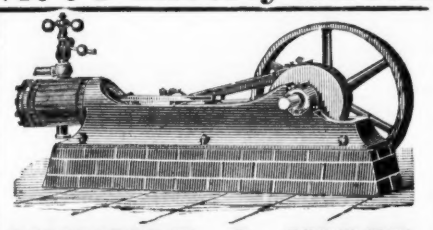

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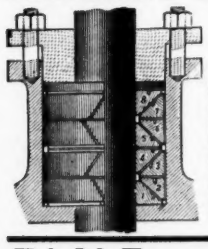

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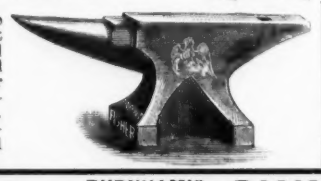

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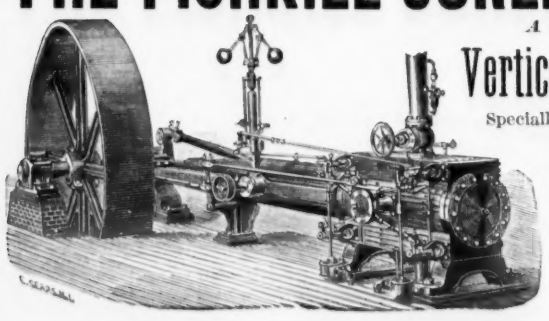

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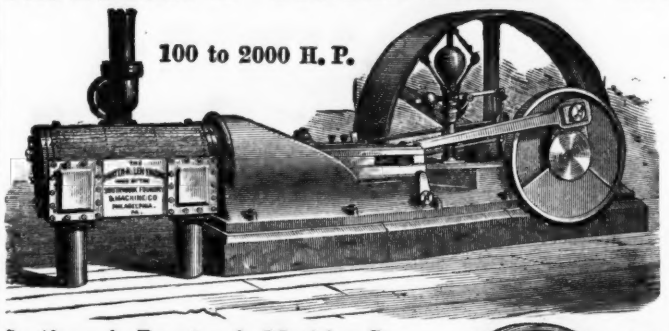

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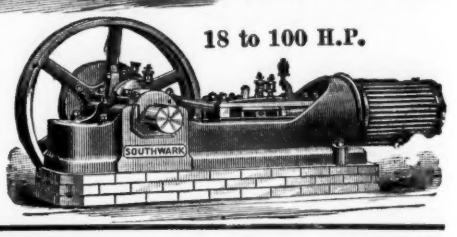

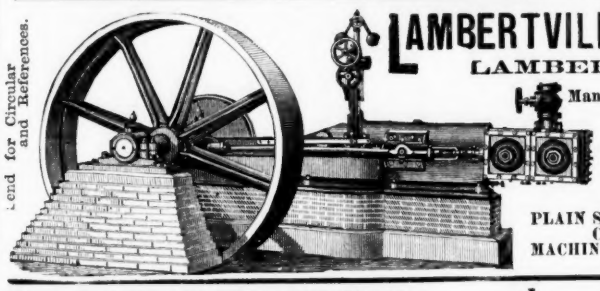

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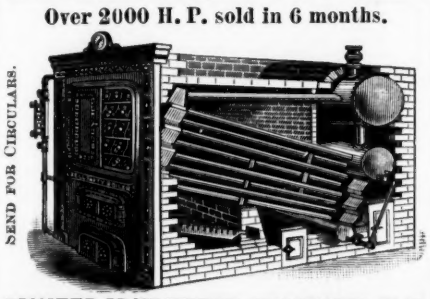

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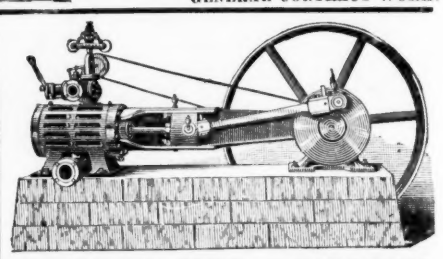

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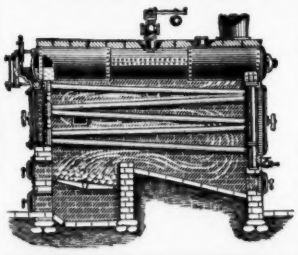

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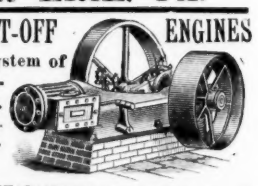

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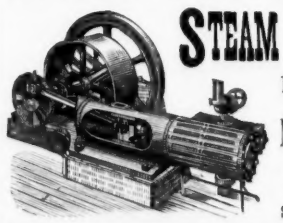

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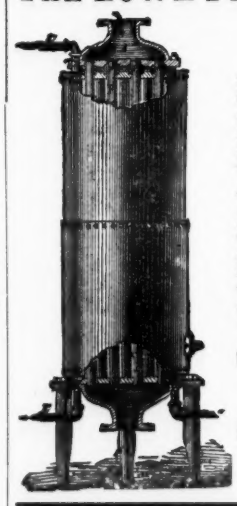

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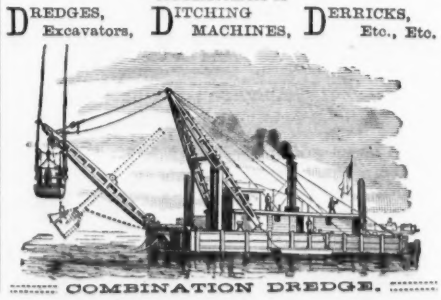

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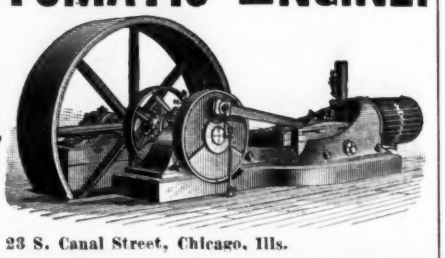

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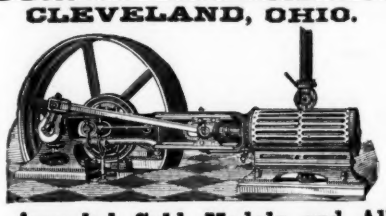

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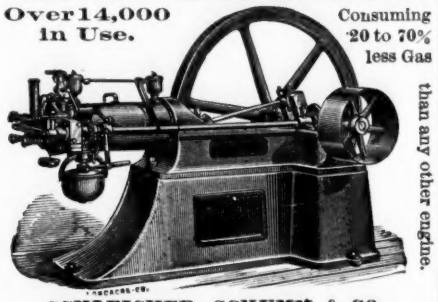

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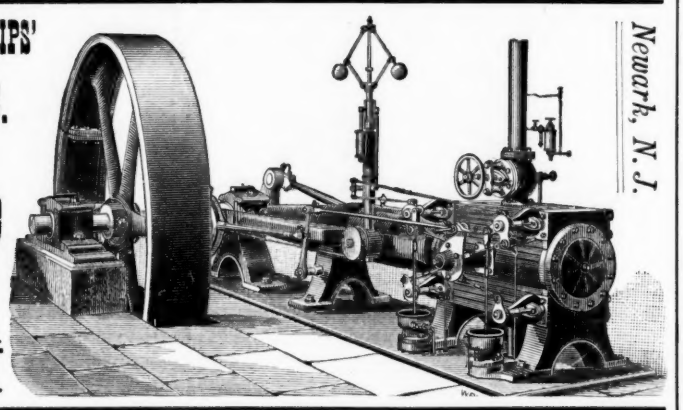

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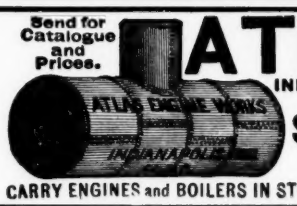

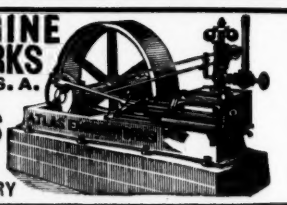

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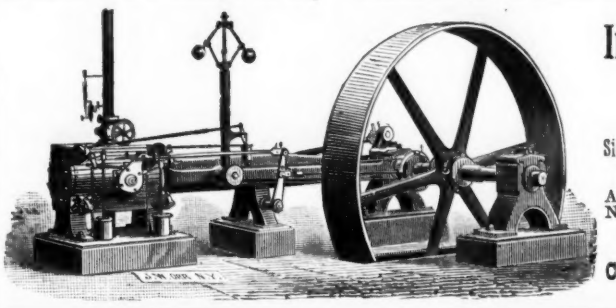

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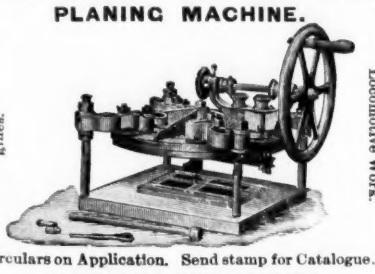

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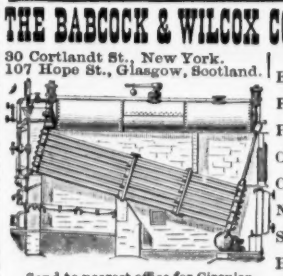

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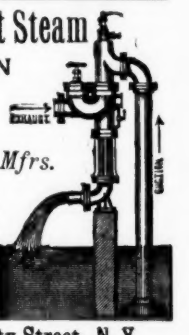

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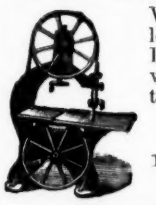

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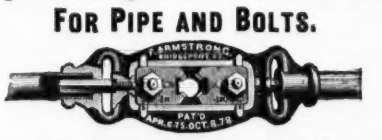

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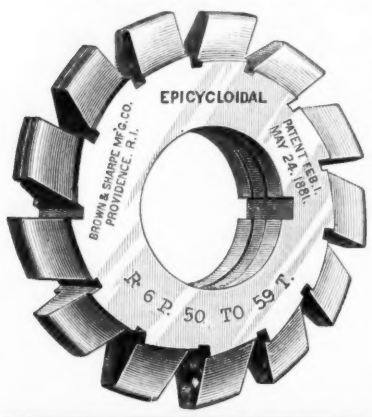

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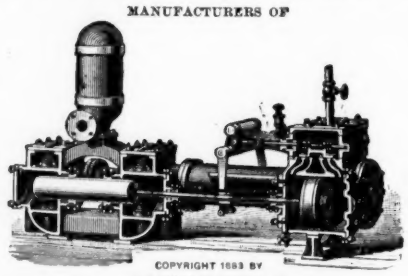

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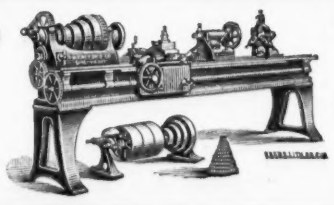

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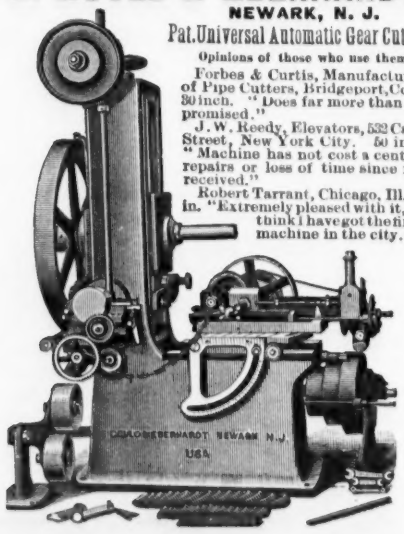

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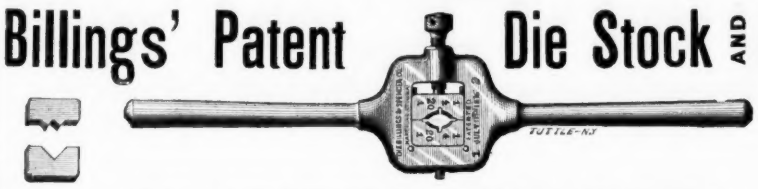

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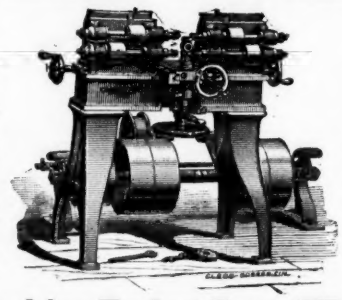

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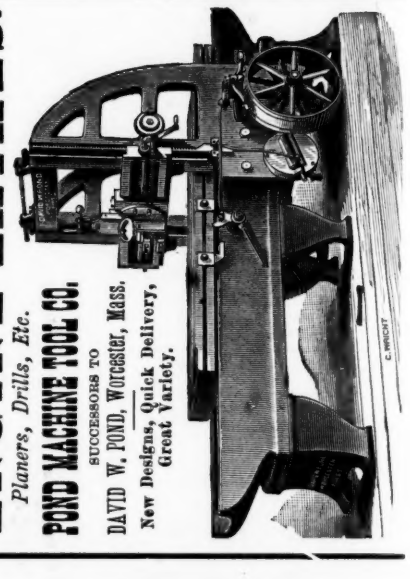

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